National Park Service
U.S. Department of the Interior

Devils Tower National Monument
Wyoming

Devils Tower National Monument
Fire Management Plan
2004

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I. Introduction

A. Reasons for Developing this Plan

This plan is mandated by and complies with National Park Service (NPS) *Director's Order #18: Wildland Fire Management* (*DO- 18*, USDI 2002), which outlines NPS fire management policy and requires that "every park area with burnable vegetation must have a fire management plan approved by the Superintendent". More specific guidance is found in *Reference Manual 18* (*RM- 18*, USDI 1999).

This plan outlines the actions that will be taken by Devils Tower National Monument (the monument or DETO) in meeting the fire management goals for the area. This plan meets the requirement of Director's Order 18 that all park units with vegetation capable of sustaining fire develop a wildland fire management plan.

B. Resource Management Relationship

This plan implements fire management policies and helps to achieve resource management and fire management goals as defined in: (1) the *2001 Federal Wildland Fire Management Policy & Program Review* (USDA/USDI 2001); (2) *Managing Impacts of Wildfires on Communities and the Environment,* and *Protecting People and Sustaining Resources in Fire Adapted Ecosystems- A Cohesive Strategy* (USDI/USDA); and (3) *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10- Year Comprehensive Strategy Implementation Plan.*

The *Fire Management Plan* (FMP) outlines fire related management actions to accomplish goals and objectives specifically identified in the monument's *General Management Plan* (GMP) and *Resource Management Plan* (RMP)(NPS 1998). Both plans for the monument specifically address the issue of fire management.

As NPS management planning becomes more science- based and proactive, fire management assumes a role of greater importance. This Fire Management Plan has been prepared to serve as a detailed program of action, which provides specific guidance and procedures for accomplishing park fire management objectives.

C. Compliance

The Devils Tower National Monument FMP is a part of the park RMP. An environmental assessment (EA) was prepared and made available for public review as part of this plan (see *Appendix D*). This FMP and the accompanying EA meet requirements of the National Environmental Policy Act (NEPA, 42 U.S.C. §4321 *et seq.*) and the National Historic Preservation Act (NHPA, 16 U.S.C. §470 *et seq.*). It will serve

as a detailed program of action, providing specific guidance and procedures for accomplishing wildland fire management objectives. Portions of the monument are within a floodplain and contain wetlands and are therefore subject to requirements of Executive Orders 11988 and 11990 of the U.S. Fire and Wildlife Act.

Cooperation and collaboration are important in land management, and particularly in fire management. Development of this plan has involved the collaborative efforts of the NPS Northern Great Plains Fire Management Office, the NPS and Midwest Region Fire Management Office, fire ecologists from other parks and agencies, and park staff. Implementation of the plan will be dependent upon collaboration with the Northern Great Plains Fire Management Office, the US Forest Service, the Northern Plains Interagency Dispatch Center, local area volunteer fire departments,, other area national park units, and all park divisions. Native American tribes will be consulted prior to approval of the plan.

D. Authorities for Implementing this Plan

This plan complies with the Service's policy guidance, the *Management Policies* (USDI 2001). The Organic Act of the National Park Service (16 U.S.C §1 *et seq.*) provides the primary authority for implementation of this plan. The Organic Act states that the primary goal of the National Park Service is to preserve and protect the natural and cultural resources under its management in such manner as will leave them unimpaired for future generations.

Federal wildland fire policy is established in the *Federal Wildland Fire Management Policy & Program Review of 1995* (USDA/USDI 1995). This policy was reviewed following 2000 fire season (USDA/USDI 2001). The 2001 Working Group found that the policy is generally sound, but recommended changes:

> In summary, the Working Group finds and recommends that federal fire management activities and programs are to provide for firefighter and public safety, protect and enhance land management objectives and human welfare, integrate programs and disciplines, require interagency collaboration, emphasize the natural ecological role of fire, and contribute to ecosystem sustainability.

Recognizing the ecological role of fire and the goal of ecosystem sustainability in federal policy reflects a fundamental change in our society's perception of fire and its role in land management. Principal conclusions of the Working Group included:

> • As a result of fire exclusion, the condition of fire- adapted ecosystems continues to deteriorate; the fire hazard situation in these areas is worse than previously understood.
> • Changes and additions to the 1995 Federal Fire Policy are needed to address important issues of ecosystem sustainability, science, education, communication, and to provide for adequate program evaluation.

In addition, the review stated, "The 2001 Federal Fire Policy and its implementation are founded on the following guiding principles:"

1. Firefighter and public safety is the first priority in every fire management activity.
2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
3. Fire management plans, programs, and activities support land and resource management plans and their implementation.
4. Sound risk management is a foundation for all fire management activities.
5. Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
6. Fire management plans and activities are based upon the best available science.
7. Fire management plans and activities incorporate public health and environmental quality considerations.
8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
9. Standardization of policies and procedures among federal agencies is an ongoing objective.

This plan is intended to follow these principles and incorporate them into all aspects of the DETO Fire Management Program. Department of the Interior policy, as specified in *Wildland and Prescribed Fire Management Policy: Implementation Procedures Reference Guide* (1998), states that all fires in wildland fuels will be classified as either "wildland fire" or "prescribed fire".

Wildland fire is defined as any non- structure fire, other than prescribed fire, that occurs in the wildland. These fires can, but do not always, achieve burning intensities capable of causing loss of life, detrimental impacts upon natural resources, and damage to, or destruction of, manmade developments.

Prescribed fire is defined as any fire ignited by management actions to meet specific objectives. These fires are conducted under prescription, and on a predetermined area that will produce the intensity of heat and rate of spread required to accomplish specific management objectives.

II. National Park Service Policy and Relationship to Other Plans

A. National Park Service Management Policies Concerning Fire Management

National Park Service management policy directs each park to prepare a wildland fire management plan appropriate for that park's purpose and resources. As stated previously, fire management at DETO is based upon this policy and the guidance found in *Director's Order #18* and the supporting *Reference Manual 18*. These guidelines

identify fire as the most aggressive natural resources management tool employed by the National Park Service.

The primary NPS policy consideration from DO- 18 is: "Wildland fire may contribute to or hinder the achievement of monument objectives. Therefore, monument fire management programs will be designed to meet resource management objectives prescribed for various areas of the monument and ensure that firefighter and public safety are not compromised." In addition, preparation of this plan meets the requirements set forth in Department of Interior Manual 620 (620 DM) and the requirements of the Federal Fire Policy update of 2001.

DO- 18 identifies the goals of the NPS wildland fire management program. These goals are:

1. Conduct a vigorous and safe wildland fire management program with the highest professional and technological standards.
2. Identify the type of wildland fire that is most appropriate to specific situations and areas.
3. Efficiently accomplish resource management objectives through the application and management of prescribed and wildland fires.
4. Continually evaluate the wildland fire program operations and accomplishments to better meet program goals by refining treatment and monitoring methods, and by integrating applicable technical and scientific advancements.

The 2001 Federal Fire Management Policy update addresses 17 distinct items, the foremost being safety; all Fire Management Plans and activities must reflect this commitment.

The monument *Resource Management Plan* states, "…. prescribed fire is essential to restore the natural scene." The project statement text for fire management notes how an absence of prescribed fire has allowed a fuel buildup that has resulted in an increased risk of catastrophic fire.

Fire once played an important role in the function of the local ecosystem. Far from being a negative and destructive force, naturally occurring fires have helped to shape the landscape over time. In many cases, the landscape today shows the legacy of past fires. Many plant and wildlife species have evolved under the influence of fire and, in some cases, depend on fire for their continued existence. To remove fire from an ecosystem deprives that system of a powerful and dynamic natural force. The ultimate goal of fire management in the National Park Service is to restore fire to monument ecosystems where possible through prescribed fires. Human–caused wildland fires will still be appropriately managed.

The presence of people, modern–day human developments, and cultural and historic

resources in and adjacent to the monument require that the protection of life and property be primary. Mechanical hazard fuel reduction and prescribed fire will be implemented to prevent loss of life or damage to resources.

It is the policy of the National Park Service to allow natural processes to occur to the extent practical while meeting management objectives.

B. Enabling Legislation and Purpose of the Monument

The monument was authorized and became the nation's first national monument by Presidential Proclamation 658 on September 24, 1906. It was established by Presidential Proclamation 658, which states in part:

> "And, WHEREAS, the lofty and isolated rock in the State of Wyoming, known as Devils Tower, situated upon public lands owned and controlled by the United States is such an extraordinary example of the effects of erosion in the higher mountains as to be a natural wonder and an object of historic and great scientific interest and it appears that the public good would be promoted by reserving this tower as a national monument with as much land as may be necessary for the proper protection thereof."

The purpose of the monument, in addition to preserving and protecting the geologic resource, was to "manage the national monument in accordance with the National Park Service 1916 Organic Act, "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations."

Values to be protected include the geologic resources, vegetation and wildlife, and the historic and prehistoric cultural resources. The enabling legislation and the National Park Service Organic Act mandate that this geologic feature and the land surrounding it be maintained in an unimpaired state for future generations.

C. General Management Plan as It Relates to Wildland Fire

Fire management is specifically addressed in the monument's 2002 *General Management Plan (GMP),* which states, "All fires burning in natural or landscaped vegetation will be classified as either wildland fires or prescribed fires. All wildland fires will be effectively managed, considering resource values to be protected and the safety of firefighters and the public. The full range of strategic and tactical operations will be used as described in an approved fire management plan. Prescribed fires are those fires ignited by managers to achieve resource objectives." The GMP also states, "To provide information on whether specified objectives are met, monitoring programs will be instituted for such fires to record fire behavior, smoke behavior, fire decisions, and fire effects."

D. Objectives of the Monument's Resource Management Plan as They Pertain to Fire Management

The *Resource Management Plan (RMP)* states that a basic resource management objective for the monument is to "Identify and protect the natural resources and processes within the monument." Fire management is generally addressed in the natural resource component of the *Resource Management Plan* in Project DETO–N–390.

E. How the Fire Management Plan Will Help Meet the Goals of the General Management Plan and Resource Management Plan

Implementation of this Fire Management Plan will support the GMP and Resource Management Plan by reestablishing fire as an ecological process that will help restore and maintain natural biotic systems.

The GMP addresses general guidance for desired future conditions through six management zones: developed, pedestrian, natural trailed, semiprimitive, special protection and administrative. The guidance for each zone allows for fire management activities to be implemented. The RMP acknowledges the need for the reintroduction of fire's role in the ecosystem.

National Park Service interdisciplinary collaboration developed the desired future conditions below for the monument with regards to vegetation and fire management. The literature cited in the environmental assessment (Appendix D) was used to provide guidance when forming the desired future conditions with the reference condition of pre 1900.

Fire Management Desired Future Conditions

- fuel load levels that are consistent with low intensity fires
- open–canopy ponderosa pine stands with overstory (dbh > 15cm) tree density in a range of 150–250 stems/ha (60–100 stems/acre) for ponderosa pine/mixed–grass savanna, and in a range of 200–350 stems/ha (80–140 stems/acre) for ponderosa pine forest
- non–native plant cover reduction with a relative increase in the native plant cover of grasses and forbs
- meadow and forest areas in various diverse stages of development
- mosaic within stands of ponderosa pines promoting habitat diversity

Current densities and desired future conditions at the monument for overstory ponderosa pine in savanna and ponderosa pine forest indicate a need to reduce overstory ponderosa pine.

III. Scope of Wildland Fire Management Program

A. Fire Management Plan Goals and Associated Objectives

Goal 1: Make firefighter and public safety the highest priority of every fire management activity.

Objective: Ensure that wildland fire and prescribed fire operations cause no injuries to members of the public. Limit injuries to firefighters to no more than 90% of the past five–year average.

Strategy: All personnel involved in fire management operations will receive a safety briefing that describes known hazards and required mitigating actions. Briefings will address established firefighter safety practices, current fire conditions, and current and predicted fire weather and behavior.

Only qualified individuals may carry out fire management operations. For wildland and prescribed fires, each individual must meet National Wildfire Coordinating Group standards listed in the *Wildland and Prescribed Fire Qualification Systems Guide* 310–1, including the fitness test. The requirement for unplanned ignitions will mandate that firefighting personnel meet the qualifications of their agencies. After initial stages, every effort will be made to utilize only personnel who meet the 310–1 standards.

Monument neighbors, monument visitors, interagency partners, and local residents will be notified of all planned and unplanned fire management activities that could affect them.

The superintendent may close all or portions of the monument to the public when fire activity poses a threat to human safety.

On every prescribed fire project there will be one person designated as responsible for safety.

Goal 2: Manage prescribed and wildland fires in concert with federal, state, and local air quality regulations.

Objective: Ensure that air quality thresholds for National Ambient Air Quality Standards are not exceeded and that visibility is not reduced in adjacent airsheds.

Strategy: Air quality impacts will be addressed in the Wildland Fire Situation Analysis and prescribed fire plans. Air quality objectives will be incorporated in each prescribed fire plan.

Smoke impact mitigation measures will be implemented for prescribed fire and all wildland fire actions. Alternative methods (e.g., mechanical, biological, etc.) to fire use will be analyzed prior to selecting fire treatments.

Goal 3: Suppress all unwanted wildland fires regardless of ignition source to protect the public, check fire spread onto private property, and protect the natural and cultural resources of the monument.

Objective: Limit 95% of unwanted wildland fires to less than 10 acres in size.

Strategy: Suppress fires or portions of fires that threaten to damage public property.

Ensure that the monument staff is trained in wildland fire operations.

Ensure that the monument fire engine is in a state of readiness during fire season.

Ensure that the monument staff members who are responsible for fire operations understand fire policy.

Goal 4: Manage wildland fires so that monument resources (natural, cultural, and improvements) are protected from damage by fire and suppression actions.

Objective: Manage suppression actions so that rehabilitation costs total less than 10% of suppression costs.

Strategy: Ensure that wildland fire suppression operations employ minimum impact suppression tactics.

Ensure that fire operations personnel are briefed on monument resources and potential damage from fire and suppression actions.

Goal 5: Facilitate reciprocal fire management activities through cooperative agreements and working relationships with other fire management entities.

Objective: Review and modify agreements with neighboring agencies annually.

Strategy: Coordinate with the following entities:

Black Hills National Forest
Crook County Fire Protection District
Wyoming Forestry Division

Goal 6: Use wildland and prescribed fire as appropriate as a tool to meet resource management objectives. Maintain and restore where possible the monument's natural resources and the natural ecological conditions that would prevail without modern civilization.

Objective: Restore fire to 25% of the fire–dependent ecosystems in the monument within the next five years.

Strategy: Achieve resource objectives such as reduction of conifer and shrub encroachment.

Improve the watershed by increasing the herbaceous cover and reducing soil erosion.

Increase native plant diversity and reduce exotic species.

Implement hazard fuel reduction burns around structures to reduce the intensity of subsequent unwanted wildland fires.

Restore fire as an ecological process.

Monitor the effects of fire on the ecosystem.

Goal 7: Reduce wildland fire hazards around developed areas, along boundaries, and in areas adjacent to cultural sites.

Objective: Ensure fire does not destroy or damage any public or private structure, nor incur any damage to any cultural or historic site.

Strategy: Apply mechanical hazard fuel reduction around structures to reduce fire intensity and severity to defensible levels.

Apply mechanical hazard fuel reduction around vulnerable cultural sites.

Goal 8: Reduce the incidence and extent of wildland fires in and around the monument.

Objective: Prevent unplanned human–caused ignitions through a fire prevention and education program for monument visitors, neighbors, and staff.

Strategy: Inform and educate through school visits, interpretive programs, public meetings, etc. Topics will include prevention, defensible space, and ecosystem maintenance.

B. Fire Management Strategies to be Applied

1. Wildland Fire Management

All wildland fires will complete Stage 1 of the Wildland Fire Implementation Plan(WFIP) in a timely manner. Stage 1 is the initial assessment or size up of the wildland fire and will serve as the decision record for selection of the appropriate management response.

All wildland fires will be suppressed using a suitable management response. The correct management response to specific wildland fires will be determined through evaluation of public and firefighter safety, fire behavior, values at risk, potential suppression damage, and the availability of fire management resources.

Management responses will vary from fire to fire and sometimes even along the perimeter of a fire. Management response options range from monitoring without on–the–ground disturbance to intense suppression actions on all perimeters of the fire.

2. Fuels Management

Hazard Fuel Reduction Management: Hazard fuels will be removed near developments and near cultural, natural, and geologic resources that would be damaged in a high intensity fire. This program will enable fire suppression forces to control fires with minimal loss of resources.

Ecosystem Management: Prescribed fires will be used to maintain and/or restore plant communities, cycle nutrients, achieve *desired future conditions* and for other resource management objectives.

Non- Fire Applications: Until the vegetation management evolves from a restoration mode to a maintenance mode, mechanical methods will be required in some areas to reduce the accumulated fuels to the point where it will be safe and practical to reintroduce fire. For example, in the area north of the tower, the North Terrace treatment unit, thinning with chain saws is necessary prior to having fire visit the area. In areas like this, piles will be created, and then burned in the winter when there is snow on the ground. Then it would be possible to use fire as a tool the following year.

C. The Fire Management Unit

The monument consists of a single fire management unit (FMU). This fire management unit encompasses all land owned and managed by the NPS at the monument.

The fire management unit includes the monument's developed areas and others that have an identified value and are at risk from fire. This includes monument boundaries, developed areas, and administrative, historic, and archeological sites.

Figure 1. General Location

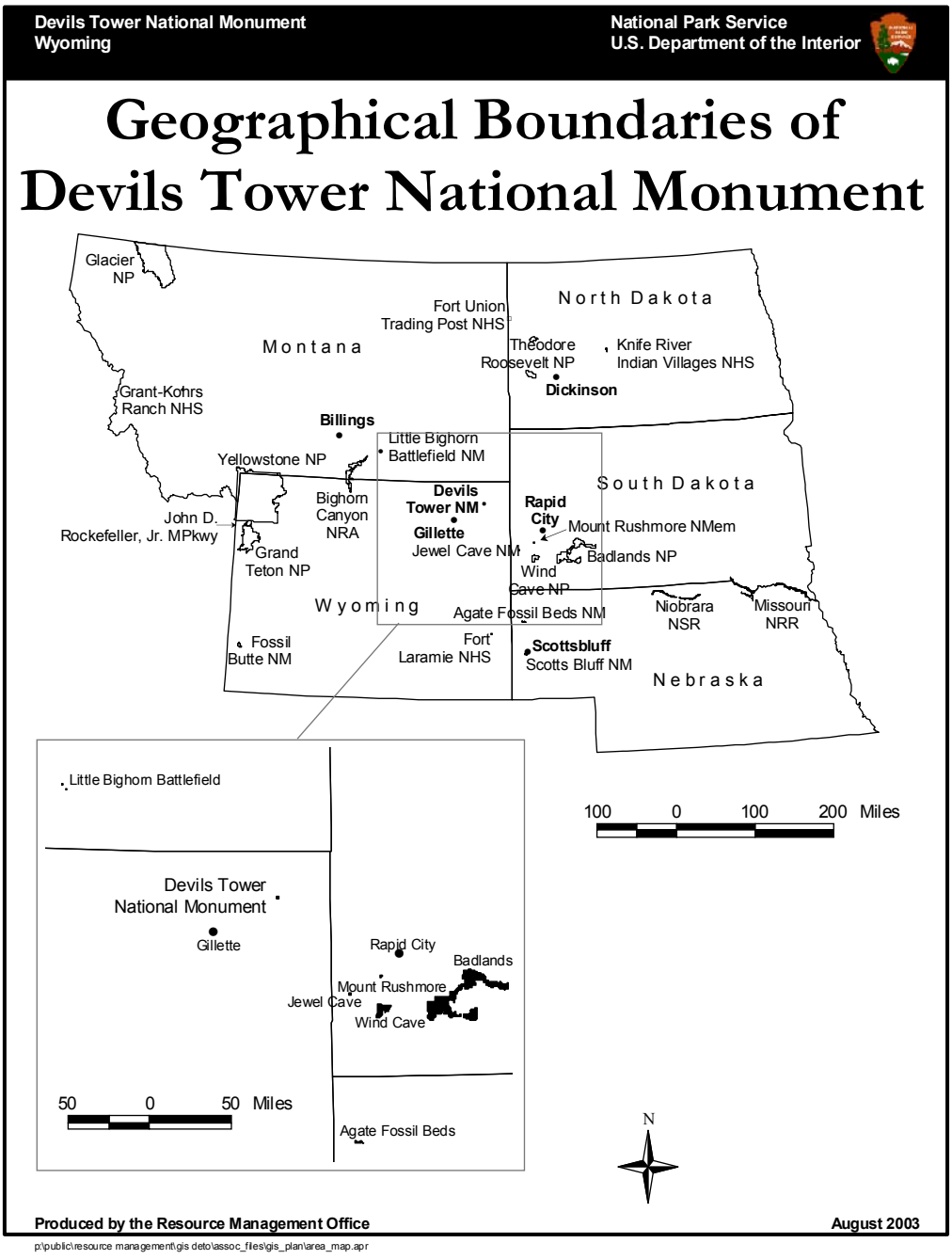
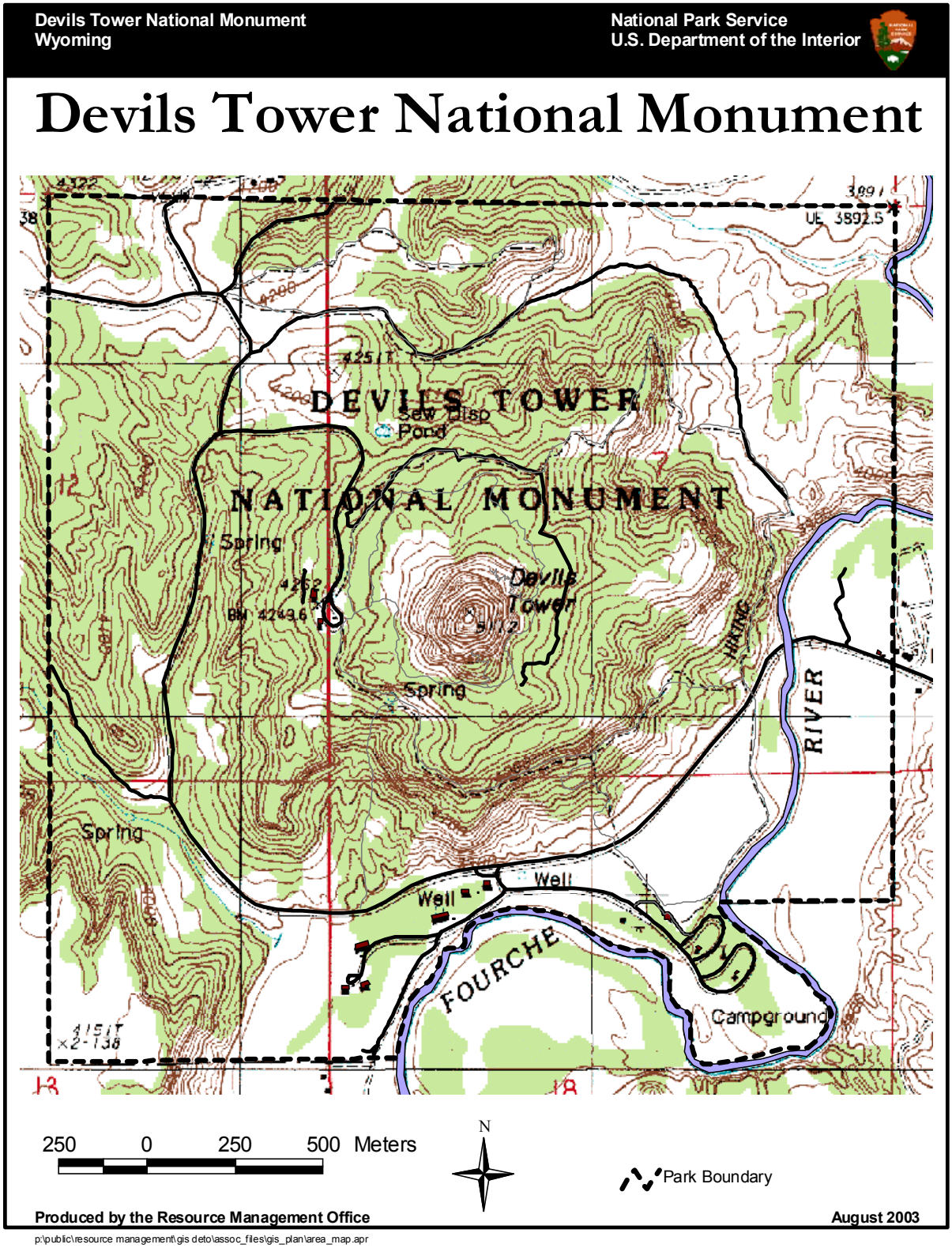


Figure 2. Site Map/Fire Management Unit



1. Fire Management Unit

a. Physical Description

The monument is a high monolith of igneous rock intruding through sedimentary layers of sandstone and shale. The Belle Fourche River meanders through the southeast corner of the monument. The fire management unit includes developed areas and geological, administrative, archeological, and historic sites. Fire suppression strategy will be coordinated with neighboring fire protection agency strategies on shared boundaries. Much of the fire management unit is accessible by paved, gravel, or dirt roads (most portions are within one mile of a road). There are also developed trails in the fire management unit.

The fire management unit includes monument boundaries, developed areas, and administrative, historic and archeological sites that have an identified value and are at risk from fire.

The monument is surrounded by private and state land. The fire management unit will encompass a buffer approximately ¼ mile wide around the monument perimeter and will include cultural, historic, or administrative sites that could be adversely affected by wildland fire.

The vegetation is predominately ponderosa pine over 62% of the monument. Along the floodplain of the Belle Fourche River and along stringers that follow tributaries of the river, there is deciduous woodland. The monument is 29% prairie.

There have been 56 exotic plant species recorded in the monument; 22 have been listed as being widespread and disruptive. Exotic plant intrusion in the monument is probably having community–level or ecosystem–level effects, significantly altering wildlife populations and natural processes. Suppression of wildfires over the last century has significantly changed the vegetation succession pattern and species composition.

No federally threatened or endangered species reside in the monument. There are 6 plant species, however, that are considered species of special concern by the Wyoming Natural Diversity Database of the Nature Conservancy (Fertig, 2000).

b. Strategic Objectives

- Contain 95% of all wildland fires at less than 10 acres.
- Restore fire to 1,300 acres of the fire–dependent ecosystem to meet resource management objectives.

c. Management Considerations to Operational Implementation

- Ensure that air quality regulations are considered in developing implementation plans.
- Ensure that there are no unacceptable impacts to known geologic, cultural, or natural resources.
- Ensure that sociopolitical and economic impacts are considered in developing implementation plans.
- Consult with monument neighbors concerning any activity that could impact them.

d. Historic Role of Fire

Fire and the lack of fire have always had a tremendous effect in shaping and maintaining the monument's vegetation. Pre–1770 there was a 15–27 year fire return interval. Native American populations began to alter the natural fire regime in approximately 1770 and decreased the fire return interval to 8–14 years. After 1900, wildland fires were suppressed. This increased the return interval to 28–42 years and subsequently altered the vegetation. Fire suppression increased the density of the woody vegetation and allowed its encroachment into the prairie areas.

In April 1984 a fire history study was completed at the monument by use of dendrochronologic techniques, aerial photographs taken on different dates, and analysis of plant opal phytolith. Results showed that three types of fires occurred in the monument.

1. *Lightning strikes* have been the most common cause of fire. They were extinguished by rainfall or by a lack of fuel continuity. Evidence of lightning fires has been found throughout the monument, most frequently near the tower itself.

2. *Regional fires,* started outside the monument, burned 1/3 to 2/3 of the monument in a single event. There were 14 such fires between 1600 and 1983.

3. *Area–wide fires* started in the monument and grew to encompass the entire monument area. There have been 15 area–wide fires since 1600; the most recent was in 1937.

e. Wildland Fire Management Situation

1) Historical Weather Analysis

The monument climate is characterized by cold winters and hot summers. Annual precipitation is approximately 18", most of which falls in the spring and summer, usually with thunderstorms. Average annual snowfall is approximately 56" with snow cover possible from October to April. June has the highest average precipitation for the year.

Temperatures can exceed 100°F during the summer, while sub–zero temperatures are possible during the winter.

Normal wind speeds range from 8–11 miles per hour. During thunderstorms or winter storms, however, locally strong winds are possible.

Table 1. 1971- 2000 Monthly Weather Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	34.2	40.2	49.3	59.6	69.2	78.8	86.1	85.8	75.6	62.0	44.0	35.5	60.2
Average Min. Temperature (F)	4.9	11.0	19.7	28.2	38.1	47.1	52.2	50.2	39.7	28.2	16.4	7.1	28.7
Average Total Precipitation (in.)	0.61	0.63	1.03	1.80	2.62	3.06	2.05	1.63	1.41	1.44	0.78	0.75	17.79

(Western Region Climatic Data Center, September 2004)

Driest Months: November thru March
Wettest Months: April thru October
Warmest Months: June thru September
Coolest Months: December thru February

2) Fire Season: The fire season generally lasts 6½ months and extends from mid April through October.

3) Fuel Characteristics

National Fire Danger Rating System Fuel Model C/ Fire Behavior Model 2

Fire danger predictions are based on National Fire Danger Rating Fuel Model C. The monument is a climate class 2 area (subhumid with rainfall deficient in the summer) and averages a 200–day annual fire season. Vegetation in this model consists of open pine stands with perennial grasses and forbs as the primary ground fuel. There is enough needle litter and branchwood present to contribute significantly to the fuel load. Much of the area is transitioning to National Fire Danger Rating Fuel Model U (also know as Fire Behavior Model 9). Normal spread in this model is primarily through fine herbaceous fuels, either curing or dead. In addition, litter and dead–down branchwood contributes to fire intensity. Surface fires spread easily. Clumps of fuel that generate higher intensities may produce firebrands and increase the risk of spotting. Extended periods of drought with extreme temperatures, low humidity, and high wind produce high intensities by reducing fuel moisture.

National Fire Danger Rating System Fuel Model A/ Fire Behavior Model 1

Less than 1/3 of the monument fits under this fuel model, which includes both

grasslands and savanna. Both annual and perennial grasses are present, but there are few areas within the savannas or grasslands in which shrubs or trees are found. The fine, very porous, and continuous herbaceous fuels that have cured or nearly cured govern fire spread. Fires in this model are surface fires that move rapidly through cured grass and associated material.

National Fire Danger Rating System Fuel Model U/Fire Behavior Model 9
This fuel model represents those areas that have a closed canopy of ponderosa pine. Dead ground fuel will continue to accumulate until reduced by either mechanical methods or fire. Grass and shrubs are typically precluded from this fuel model with the exception of occasional natural openings. Fires are usually surface fires burning through litter accumulations, but occasional torching of trees may occur. During severe burning conditions this model can sustain a rapidly spreading crown fire.

Table 2: Fire Behavior Characteristics

Extreme Conditions*

Fuel Model	Rate of spread	Flame Lengths	Fire Characteristics
Fuel Model 2	40 chains/hour	6.5'	Surface fires can spread very rapidly. Fire may get into crowns in heavy fuels resulting in firebrands that may start spot fires well ahead of the fire front.
Fuel Model 1	126 chains/hour	5.6'	Fires in this fuel model will move fast. They will have a short residence time as these fuels are consumed rapidly.
Fuel Model 9	64 chains/hour	8.0'	Torching and crown fires can readily occur under these conditions. High spotting potential and rates of spread exists. Surface fires will burn with increased intensity and rates of spread.

Normal Conditions**

Fuel Model	Rate of Spread	Flame Length	Fire Characteristics
Fuel Model 2	35 chains/hour	6.0'	These fires will tend to torch out periodically, but most of the time they will be ground fires. Torching will occur on sites with heavy fuels near a tree or clump of trees.
Fuel Model 1	78 chains/hour	4.0'	These fires also exhibit fast rates of spread. They will burn out rather quickly.
Fuel Model 9	8 chains/hour	3.0'	Fires display slow to moderate rates of spread and can usually be attacked directly. Residence time can be lengthy if large ground fuels are present.

(Anderson, 1982)

*Extreme is for slopes greater then 41%, 1 hour fuel moisture 3%, and midflame wind speed of 10 miles per hour.
**Normal is for slopes less then 40%, 1 hour fuel moisture 6%, and midflame wind speed of 4 miles per hour.
Note: 1 chain = 66 2/3 feet

4) Fire Regime Alteration: Fire suppression and land use practices such as livestock grazing have been in place for about 100 years. The result has been the almost complete exclusion of fire from the monument, which has significantly altered the ecosystem.

5) Control Problems: Specific areas with potential control problems are where slope, exposure, and wind could result in extreme rates of spread. Taller grass species increase control complexities. Special concerns for this fire management unit are areas with unnaturally high fuel loads and hazardous fuel buildup along the monument boundary.

6) Values To Be Protected

- Private and state land and developed areas adjacent to the fire management unit boundary.
- Administrative sites, parking lots, bridges, signs, and fences are to be protected.
- Known archeological and historic sites will be acknowledged and mitigation measures will be used during prescribed fire operations.
- Protect and maintain aesthetic qualities throughout the monument.

IV. Wildland Fire Management

A. General Management Considerations

1. Management Direction

All wildland fires will be suppressed using the correct management response. The intent is to enhance safety while preventing the loss of structures and property. The top priority during the selection of the suppression action will be the safety of personnel and the public, including adjacent landowners.

2. Implementation Procedures

All wildland fires will be suppressed and will have Stage 1 of the Wildland Fire

Implementation Plan completed in a timely manner. Specific requirements are identified in chapter 4 of the *Wildland and Prescribed Fire Management Policy Implementation Guide*. The incident commander is responsible for completion of this document.

B. Wildland Fire Use

Wildland Fire Use will not be considered as a fire management activity at this monument due to its limited acreage, public safety and close proximity to public property.

C. Wildland Fire Suppression

1. Range of Potential Fire Behavior

Fire behavior at the monument can range from fast moving surface fires in light fuel to stand replacement fires on upper and mid slopes. For more detailed discussion refer to the fire behavior information in Section III, *Scope of Wildland Fire Management Program*.

2. Preparedness Actions

a. Prevention and Prescribed Fire Educational Activities

Fire prevention and fire education include all activities designed to reduce the number of human–caused wildfires. The objective is to minimize preventable fires through increased public awareness.

Prevention and education activities for the monument will include signs, messages delivered by monument staff, and prevention watches during periods of high fire danger. Prescribed fire awareness messages will be tailored for the general public.

The monument staff may participate in fire prevention and education activities at local schools. Staff can meet with community groups to ensure that the general public is aware of the importance of fire prevention and all other aspects of fire management.

During periods of high fire danger, the general public and monument visitors will be kept informed of conditions through press releases, interpretive media, and signs at monument entrances, the visitor center, and the campground.

Nationally, the first week of July is historically a high fire danger period. In the past, a number of fires have been started by fireworks. During this week, the visiting public will be reminded of the laws restricting the use of fireworks in the monument and the policy regarding contained fires.

b. Annual Training
Training will consist of fire fighter refresher training, first aid, and safety training. The monument should have a Single Resource Boss on site or able to respond within 30 minutes.

c. Annual Preparedness Activities

January
Perform fire physical exams and fitness tests as per standards in *Reference Manual* 18.

Review and update cooperative agreements with neighboring fire management agencies.

February
Inventory fire equipment, order supplies, and update equipment list. Include the fire cache and personal equipment.

Review step–up plan.

Inspect all fire equipment.

Check operation of engine pump and backpack pumps.

Check established procedures for using suppression and emergency preparedness accounts.

Complete and update all prescribed fire plans for spring season and have them signed by the superintendent.

March
Obtain or prepare signs regarding prescribed fire interpretation.

March to Mid October (Fire Season)
Inspect all fire equipment for readiness; operate engine monthly.

Complete all prescribed fire plans for the fall season and have them signed by the superintendent.

November
Critique fire season, including all fire management activities (i.e. wildland fire suppression, prescribed fires and mechanical fuel treatments, prevention, etc.)

Evaluate individual performance of monument staff to correct deficiencies and

recommend personnel for training.

December
Review and revise *Fire Management Plan* as needed.

Update and submit fire experience and training to NPS Shared Applications Computer System through the Northern Great Plains Area Fire Management Office.

d. Fire Weather and Danger
Preparedness activities during the fire season are based on the national fire danger rating system. Fire days are divided into five staffing classes according to the intensity of danger factors indicated by the burning index.

The burning index integrates the effects of weather, fuels, and topography to estimate potential fire behavior and the corresponding amount of effort required to contain a fire. The staffing classes relate to the expected severity of fire conditions.

Preparedness actions are based on the predicted fire weather before 2:00 PM and on actual fire weather after 2:00 PM for all staffing classes.

The burning index is determined from weather data obtained from a remote automated weather station (#480606). The analysis was based on the national fire danger rating system, fuel model C, a slope class of 2 (26–40% slope), perennial herbs, and a climate class of 1 (semi–arid).

Table 3: Burning Index and Staffing Class

Burning Index and Staffing Class	
0–10	I (Low)
11–20	II (Moderate)
21–42	III (High)
43–51	IV (Very High)
52+	V (Extreme)

e. Step–Up Staffing
The superintendent and Fire Management Officer have the ability to move up one preparedness staffing class for monument events that could increase the potential for wildland fire.

<u>Staffing Class I and II (Burning Index 0–10)</u>
Conditions: Fire would present a low to moderate level of control difficulty.

Fires occurring at this level could be controlled with onsite forces. Wind speed and direction would determine severity of fire spread. Fine fuels will be drying.

Preparedness Actions
Fire weather reviewed daily.

Hand tools and portable equipment kept ready.

Initial attack will consist of a minimum of two individuals (1 type V incident commander and 1 type II firefighter) with the monument's engine.

Additional attack forces will be dispatched after size–up and upon request of the first firefighter to arrive.

If necessary, cooperator assistance will be requested as described in the *Northern Great Plains Mobilization Guide*.

Funding Source: These activities will be funded through programmed monument accounts or non–emergency FIREPRO funds.

Staffing Class III (Burning Index 11–42)
Conditions: Fires would present a moderate level of control difficulty. Light and heavy fuels will be drying. Mop–up would be more difficult and time–consuming.

Preparedness Actions:
All actions specified for staffing class I – II days will also be implemented at this level.

Initial attack will consist of a minimum of four individuals (1 type V incident commander and 3 type II firefighters).

Funding Source: These activities will be funded through programmed monument accounts or non–emergency FIREPRO funds,

Staffing Classes IV and V (Burning Index 43+)
Conditions: Fire would present a moderate to high level of control difficulty. Initial attack and reinforcing crews could have difficulty controlling a fire at this level. All fuels will be dry. Air temperature will be high and humidity low. Strong gusty winds will be possible. Spotting would be likely.

Preparedness Actions
All actions specified for staffing class III days will also be implemented at this level.

Initial attack will consist of a minimum of four individuals (1 type V incident commander and 2 type II firefighters).

Visitor center personnel will alert the public to fire conditions and hazards.

Interpretive activities will include a fire safety message.

Fire danger notices will be posted.

Temporary closures may be placed in critical areas when fire or the threat of fire could compromise life safety.

Funding Source: FIREPRO emergency funds may be used at these staffing classes with the approval of the Northern Great Plains Area Fire Management Office. Both nonessential routine activities and project work may be postponed on staffing class IV and V days.

3. Pre–Attack Plan

Due to the small size and scope of the fire program at the monument, no formal pre–attack plan has been written. Preparations and procedures are established prior to and during the fire season. Preparations are also mentioned in the Annual Preparedness Activities (section IV, C, 2c); other pre–attack plans are informally discussed among the monument staff and neighboring cooperators during practice or equipment maintenance assemblies. A pre–attack checklist is given in appendix G.

4. Initial Attack

Whenever fire is reported within monument boundaries, the following steps will be taken:

1. Report of the fire to the DETO Office. This office will contact the Northern Great Plains Dispatch Center for needed resources and the Fire Program Coordinator will begin dispatch duties and radio operation.
2. Determine the location, legal description, and land ownership at the occurrence site.
3. At least two or more Devils Tower personnel will be dispatched to the location of the fire. Personnel dispatched will be qualified and equipped to undertake initial attack action.
4. Division Chiefs will be notified of the need to put their available personnel on standby (during normal duty hours). All personnel placed on standby will assemble at the appropriate staging area.
5. Immediately upon arrival at the fire location, a Stage I Wildland Fire Implementation Plan (WFIP) will be completed. Information obtained for the Stage I WFIP includes a report of the fire size, behavior, environmental

conditions, fuels, terrain features, existence of special hazards or threats to persons or improvements, and any other factors observed which could affect fire behavior and suppression efforts. This information will be reported to the Fire Program Coordinator. These fire size–up observations will be immediately forwarded to the Northern Great Plains Dispatch Center and Northern Great Plains Fire Management Office (NGPAFMO).

All wildland fires will receive an immediate and safe, aggressive initial attack response. The first qualified Incident Commander on–scene will determine the appropriate suppression strategy to be utilized. The Fire Program Coordinator or his/her designee will keep the Superintendent updated of the fire situation. The goal in initial attack actions is to limit damage to threatened values, while minimizing the area burned and preventing escape of the fire. An Incident Commander Type V (ICT5) will be responsible for all actions taken on the fire. The ICT5 will inform the Area Fire Management Officer of the fire situation as soon as possible after arrival on the scene. If the fire behavior and complexity continue to increase, the ICT5 may be replaced by an ICT3 along with additional support personnel and equipment. The Area Fire Management Officer, Fire Program Coordinator, or their designee is responsible for the selection of a replacement Incident Commander.

a. Priority Setting Resources during Multiple Fires

Occasions in which two or more fires are ignited can be generally associated with days when high to extreme fire intensity conditions exists. Suppression actions taken on multiple fires can quickly deplete DETO fire suppression resources. At least two individuals will be dispatched to each fire reported on days experiencing multiple starts. However, if sufficient personnel are not immediately available, the priority order will govern which fires in which units will receive the first available personnel resources and needed resources will be ordered through the Northern Great Plains Dispatch Center. Priority of initial attack on days of multiple fire starts will be:

1. Fires threatening life or property within monument boundaries;
2. Fires starting within the monument which are within one mile of monument boundaries and which are likely to burn across the boundary and onto non–monument lands;
3. Fires starting outside the monument which are within one mile of monument boundaries.

b. Criteria for the Initial Attack Response Is Consistent with Monument's General and Resource Management Plan Objectives

- public and firefighter safety

- protection of cultural, historic and natural resources
- protection of improvements and private property
- minimum fireline construction
- suppression resources and response times
- fire danger as determined by fuels, weather, and topography

c. Confinement as an initial attack strategy

A confinement strategy may be selected for initial attack as long as it is not being used solely to meet resource management objectives. Resource benefits may be a side benefit but the strategy must be based upon the criteria such as values at risk, probability of success, consequences of failure, cost, and management objectives, public and adjacent landowner concerns are some additional considerations in selecting the most appropriate strategy. The preferred strategy should be implemented as quickly, safely and efficiently as possible. A confinement strategy will follow the same management process as for wildland fire use decisions with a WFIP prepared in stages as the fire or management considerations dictate.

Confinement can also be a strategic selection through the Wildland Fire Situation Analysis (WFSA) process when the fire is expected to exceed initial attack capability or planned management capability.

The federal fie policy allows managers to select the most appropriate suppression strategy. In selecting the most appropriate strategy firefighter safety should be the primary consideration.

d. Typical Fire Response Times

Typical fire response times at the monument vary depending on staffing, fire management activity in the area, and time of day. During the fire season when no other fires are burning and staff is available, the monument engine can respond to fires within 30 minutes. Reinforcements from local agencies through the Northern Great Plains Interagency Dispatch Center can respond to a fire in the monument within 1 hour. Air tanker and helicopter attack can typically reach a fire within 1 to 2 hours. Reinforcements from outside the Northern Great Plains Interagency Dispatch Center dispatch area may not arrive until about 8 hours after a request for them is made. All response times are subject to availability of firefighting resources.

e. Restrictions and Special Concerns:

- The superintendent must authorize the use of any off–road mechanized equipment.

- Minimum impact suppression tactics will be used when ever possible.

- Aerial delivery of fire retardant will be no closer than 500 feet from the Tower

5. Extended and Large Fire Suppression

There are wildland fires that cannot be controlled during the initial suppression response action. These may also be prescribed fires where the implemented prescription or actions are unsuccessful. The WFSA is initiated at this stage.

a. Determining extended attack needs – If a fire threatens to exceed the initial attack capabilities of the monument and local cooperating agencies, an Interagency Fire Management Overhead Team will be immediately requested by the Incident Commander or Northern Great Plains Fire Management Officer through the Northern Great Plains Interagency Dispatch Center. The amount and type of assistance needed and requested will depend on the present and expected complexity of the fire situation, and be documented on a Resource Order Form (NFES–1470).

b. Implementation plan requirements – WFSA development –Preparation of the WFSA for extended attack and large fire suppression should be done to evaluate suppression responses to wildland fires that have exceeded initial attack response or exceeded planned management capability. Enhanced resource benefits may be a side benefit of the planned action under the WFSA, but cannot be part of the objective of the action. Procedures for the WFSA process are outlined in the Wildland and Prescribed Fire Management Policy Implementation Guide.

c. Complexity decision process from initial attack to extended attack – The Incident Commander will determine when the fire exceeds initial attack capability, and that additional resources need to be ordered. The following issues also need to be considered when evaluating the need for activation of an incident management team:

    - Is the park nearing depletion of Initial Attack (IA) resources?
    - What is the availability of additional resources within the state and nationally?
    - What is the fire burning in and what is the chance of holding it under current and predicted conditions?
    - What are the available air resources?
    - What is threatened – urban interface, special management areas, etc.?
    - What are the logistics issues of the incident – remote access, wilderness area, etc.?

The objective is to take the burden off the park when an incident exceeds local capabilities.

d. "Delegation of Authority" Letters for Incident Commander. Should fire activity and complexity warrant the ordering of an Incident Management Team as discussed above, a Delegation of Authority will be signed by the Superintendent and incoming Incident Commander giving the team authority to manage the incident. Examples of Delegation of authority letters are found in Appendix E.3.

6. Fires Exceeding Existing Wildland Fire Implementation Plan (WFIP)

When wildland fires cannot be controlled during the initial suppression action or when the appropriate management response in a fire use area has not been successful, the WFIP is considered to have been exceeded. The WFSA is initiated at this stage. Initiation of the WFSA is also necessary when implementation of a prescribed fire plan is not successful and the fire must be suppressed. The following parameters and considerations will be used in WFSA preparation at DETO.

Situations that could require selection of a new strategy through the WFSA include but are not limited to:

- Unacceptable risk to firefighter safety, natural or cultural resources, improvements;
- Fire leaving or threatening to leave the park boundary;
- Fire exceeds prescribed fire plan;
- Increasing demand on local and/or national fire management situation
- Agency administrator prerogative.

7. Minimum Impact Suppression Tactics

Minimum Impact Suppression Tactics (MIST) are required policy for all fire management activities on National Park Service lands. Fire management activities within the park will be carried out in a manner that minimizes impacts to Devils Tower's natural and cultural resources. Fire camp facilities, when practical, will be located outside of the Monument's natural and historic zones. Of primary importance is the need to impart upon suppression forces a minimum impact fire suppression philosophy. Suppression forces will choose methods and equipment commensurate with suppression needs and the appropriate management response strategy which least alters the landscape or disturbs monument natural and cultural resources. This policy is an attempt to take the national park ethic into account in firefighting practices; it is not a reason to relax normal safe firefighting practices. Some examples of minimum impact firefighting include:

- Use water instead of fire retardant chemicals in Airtankers.
- Cold trail the fire–edge when practical.
- Wetlines, or environmental lines, will be used wherever possible in lieu of handline construction if water and pumps are available. Waterbars will be constructed on handlines on steep slopes.
- Utilize soaker hose or foggers in mop–up. Avoid "boring" and hydraulic action on shallow soils.
- Firelines will be kept to the minimum width necessary to allow backfiring or safe blackline to be created. Utilize natural barriers wherever possible to avoid "tunnel effect."
- If a mineral soil line is needed, utilize fireline explosives whenever possible instead of heavy equipment. As a general rule, heavy equipment will not be used in the monument and only used in the most–worst case scenario and with the written approval of the Superintendent.
- Decisions on suppression practices will be made by the Incident Commander. Utilize his/her creativity.
- Minimize tree falling. If necessary to fall trees in visually sensitive areas (i.e., trails, roadways), utilize "slant cut" technique to face cut away from view, or re–cut later during rehabilitation activities.
- Archeological sites will be identified prior to a fire and protected wherever possible. Minimize ground disturbance to protect cultural resources.
- Scatter or remove debris as prescribed by the Incident Commander.
- All firelines, spike camps, or other disturbance in visually sensitive areas will be rehabilitated to maintain a natural appearance.
- After the fire emergency is over, transport of personnel, equipment, and trash out of the park will be consistent with national park resource management objectives.

8. Rehabilitation

After the fire is declared out, all litter and trash will be removed from the incident. Firelines will be refilled and erosion control devices will be installed if necessary. The severity of the burn and its resultant impacts will be considered in determining the need to seed or otherwise reestablish native plants. Landscaping and planting will be in full compliance with NPS management policies and will have the prior approval of the regional director. A rehabilitation plan will be prepared before any action is taken. It will include species to be planted, techniques to be used, locations, and cost estimates.

9. Records and Reports
The Northern Great Plains Fire Management Officer is responsible for all fire management records and reports.

a. Individual Fire Report: The form for documenting a wildland fire is the Individual Fire Report (Department of Interior Form DI 1202). The report provides a historical record of the fire regime for the monument. All fires within the boundaries must be documented with this form, including fires that go out on their own. The form is also used by the Department of Interior to record fire occurrences. Support actions in which monument personnel respond to fires outside the monument (including out of state) are also to be reported on this form. For firefighters to receive credit for work performed on any fire, the National Park Service must have a DI 1202 with an incident number on file.

The incident commander for the fire is typically the person responsible for preparation of the individual fire report. In most cases, this is the individual who put the fire out. That person may also complete a Case Incident Report (Form 10–343). The Northern Great Plains Fire Management Office Fires will assign each fire a number. Instructions for filling out the report are found in *Reference Manual* 18.

For large fires, a complete fire report will include, as applicable:

- written policies, guidelines or authority statements signed by the superintendent
- copies of equipment purchased or personnel request orders
- all situation maps
- personnel lists, including emergency firefighter time slips
- press clippings
- accident reports
- all weather data reports and records
- documentation of financial charges made against the incident
- rehabilitation plan

The completed individual fire reports are to be submitted to the Northern Great Plains Area Fire Management Officer, who will review the report and enter it into the NPS wildland fire management computer system.

b. Training And Experience Records: The Shared Applications Computer System at the National Interagency Fire Center is the central repository for all individual fire experience and training records. The Northern Great Plains Area Fire Management Officer is responsible for entering all training and experience data into the computer and for ensuring that the information is up to date.

c. Daily Situation Report: Daily situation reports are required on those days when the burning index reaches the 90th percentile and the monument moves into staffing class IV and V or when a fire has started or is on going. The monument will notify the Northern Great Plains Area Fire Management Officer, who will enter the report into the NPS Shared Applications Computer System by 9:30 AM THE FOLLOWING DAY.

d. Resource Order Form: All assistance requests must be documented on the Resource Order Form (National Fire Equipment Schedule Form 1470). These forms can be transmitted by telephone. The order form is an obligating procurement document.

e. Delegation of Authority: Whenever an incident management team is ordered, the superintendent must provide a written limited delegation of authority and a briefing package to the incoming incident commander. The Northern Great Plains Fire Management Officer has templates for this document.

V. Fuels Management

A. Scope of Prescribed Fire Program and Links to Resource Management

Prescribed fire is important to the management of vegetation communities and to the achievement of resource management goals. The *Resource Management Plan* states that there is a need to "…conduct prescribed burns, manage exotic plants, and restore the functioning of disturbed vegetation communities."

As previously discussed in Section II of this plan, National Park Service interdisciplinary collaboration developed desired future conditions for the monument with regards to vegetation and fire management. These desired future conditions also contain fuels related conditions. The literature cited in the environmental assessment (Appendix D) was used to provide guidance when forming the desired future conditions with the reference condition of pre 1900.

The vegetation communities have been altered by extensive grazing by cattle, sheep, and goats during the late 1800s and early 1900s and by fire suppression. Grazing and fire suppression have led to a decrease in native grasses and herbaceous cover and an increase in woody species. As woody species increase and age, grass and herbaceous surface vegetation tend to decline.

Fire suppression and grazing have resulted in an increase in fuel loading. The monument has excluded grazing, which has increased the potential for successful restoration of native grass and forbs–dominated communities after fires. Restoration of

fire to the ecosystem would help to return the area to natural conditions. Cutting woody species could restore native grasses and forbs while causing fewer impacts to air quality, but many native plants require fire to scarify seeds and prepare the growing site. With the use of cutting alone, nutrient cycling would continue to take centuries, gradually impoverishing the soil. Mowing and prescribed fire could be used to manipulate the fuel bed. Prescribed fire is the single most appropriate management action to facilitate the restoration of native vegetation and natural ecosystems.

The prescribed fire program must focus on restorable sites that could support the desired plant communities. This plan does not suggest wholesale removal of all woody species as these species play a very important role in the vegetation community that historically occupied riparian and other sites with rocky and shallow soils. The prescribed fire program should focus on reducing encroaching woody species and maintaining a natural mix of native grasses and forbs.

B. Prescribed Fire

1. Annual Planning Activities

Prescribed fire plans should be prepared well in advance. The superintendent, prior to any ignition, must approve all prescribed fire plans. In addition, all prescribed fire plans will be technically reviewed by a prescribed fire specialist or Fire Management Officer from outside the Northern Great Plains Area Fire Management Office. A prescribed fire plan may have multiple units if these units have similar vegetation types, prescriptions, and resource management objectives.

Prescribed fire units may vary in size, but larger units better assist in landscape scale restoration. Prescribed fire boundaries should use the natural features (slope, aspect, and vegetation), natural fuel breaks, and roads and trails for perimeter control. Proposed construction of perimeter fire control lines should be evaluated for impacts to natural and cultural resources, cost, and defensibility. Boundary and fence lines are often costly to construct, and they increase risk to fire fighter safety during holding operations.

2. Long–Term Prescribed Fire Strategy

The goal of the program is to reintroduce fire into the ecosystem at the monument. This will be done through a rotational series of prescribed fires that will coincide with the historic return interval. A 5–year prescribed fire schedule can be found in Appendix H.

3. Personnel Needed to Plan and Execute the Prescribed Fire Program

Planning and execution of this prescribed fire management program will be done by qualified personnel as determined by National Wildfire Coordination Group standards and will follow the guidelines in *Reference Manual* 18.

The monument does not have sufficient qualified staff to independently implement prescribed fire projects. The Northern Great Plains Area Fire Management Officer and adjacent agencies must assist in planning and implementing each of the prescribed fire.

4. Prescribed Fire Monitoring
The monument will develop a short– and long–term monitoring program to measure attainment of prescribed fire objectives. Qualitative and quantitative changes in resources will be measured and the results will be used to guide modifications for subsequent prescription treatments (see section VIII of this plan, Monitoring).

5. Prescribed Fire Critiques
Critiques should address prescribed fire objectives, implementation, equipment and safety issues. Possible improvements to the planning and implementation process should be discussed.

6. Reporting and Documentation Requirements
See *Reference Manual* 18, Chapter 10, Prescribed Fire Plan section.

C. Prescribed Fire Plan Requirements

Refer to *Reference Manual* 18, Chapter 10, Wildland and Prescribed Fire Management Policy and Implementation Procedures Reference Guide.

D. Exceeding Prescribed Fire Plan

If prescribed fire prescription parameters are exceeded during ignition, but the fire remains within unit boundaries, actions must be taken to keep the fire within the unit boundary.

If the prescribed fire is declared "escaped", then a Wildland Fire Situation Analysis must be completed and the management must respond. Spot fires may not constitute an escape if they are contained within standards identified in the prescribed fire plan.

E. Air Quality and Smoke Management

1. Pertinent Air Quality Issues
The subject of air quality and its effect on the resources of the monument and visitor enjoyment of those resources, is of great concern to monument managers and local residents. The quality of the airshed for the monument and the surrounding valley should be discussed with all concerned parties in order to heighten awareness and support for the prescribed fire program. In day–to–day operations, monument staff will ensure minimal impact on all monument resources, including air quality.

2. Smoke Management Planning and Implementation Measures
The fire management program for the monument will be in full compliance with interstate, state, and local air pollution control regulations as required by the Clean Air Act, Title 42, USC 7418. State air quality clearances and permits will be obtained prior to the ignition of prescribed fires. Smoke will be monitored for trajectory, mixing height, and impact to air quality.

Goal 1: Monument staff and visitors will be protected from unhealthy levels of air pollution from prescribed fires.

> Objective: Do not exceed ambient concentrations of particulate matter (PM_{10} and $PM_{2.5}$) established by the Environmental Protection Agency National Ambient Air Quality Standard.
>
> Objective: Keep ambient concentrations of carbon monoxide measured below the Environmental Protection Agency National Ambient Air Quality Standard.
>
> Strategy: Use state–of–the–art fire management practices to foster smoke dispersion or limit the size of the prescribed fire to reduce particulate matter. The Simple Approach Smoke Estimation Model (or equivalent) will be used to estimate particulate matter and carbon dioxide concentrations and to ensure that the proposed prescribed fire does not cause National Ambient Air Quality Standard violations. On–site monitoring will be conducted to determine particulate matter concentrations and smoke dispersion for prescribed fires that could significantly affect the local airshed for more than one burning period.

Goal 2: Average visibility in the monument will not be impaired to such an extent that the neighboring airshed is seriously affected.

> Objective: Smoke plumes will disperse within 10 miles downwind of the fire as observed from a point perpendicular to the smoke trajectory.
>
> Strategy: Management practices will foster rapid transport and dispersal of smoke. Ignition will be timed to maximize dispersion and to limit smoke production during those times of day when air mixing is less likely.

3. Smoke Management Practices
Burn when meteorological conditions allow for good smoke dispersion.

Use ignition techniques that produce high intensity fires with short duration impacts when possible.

Ignite prescribed fires under good–to–excellent ventilation conditions and suspend operations under poor smoke dispersion conditions.

Consider smoke impacts on local communities.

Implement prescribed fires only to meet resource management objectives.

Minimize smoldering by considering fuel moisture.

Burn slash piles only when other burns are not feasible.

Use all opportunities to meet the burn prescription and vary burn locations to spread smoke impacts over time and geographic areas.

Burn during optimum midday dispersion, with all ignitions completed by 3:00 PM to prevent trapping smoke in inversions or diurnal wind patterns.

Implement maintenance burning in a periodic rotation to mimic natural fire cycles and reduce excessive fuel accumulations.

Manage smoke impacts by:

- limiting smoke impact to levels that allow safe vehicle use
- use of signs if smoke will impact visibility on roads
- determining nighttime impacts and taking appropriate precautions
- contacting appropriate authorities regarding smoke or visibility impacts.

F. Non–Fire Applications

Until the vegetation management evolves from a restoration mode to a maintenance mode, mechanical methods will be required in some areas to reduce the accumulated fuels to the point where it will be safe and practical to reintroduce fire. For example, in the area north of the tower, the North Terrace treatment unit, thinning with chain saws is necessary prior to having fire visit the area. In areas like this, piles will be created, and then burned in the winter when there is snow on the ground. Then it would be possible to use fire as a tool the following year.

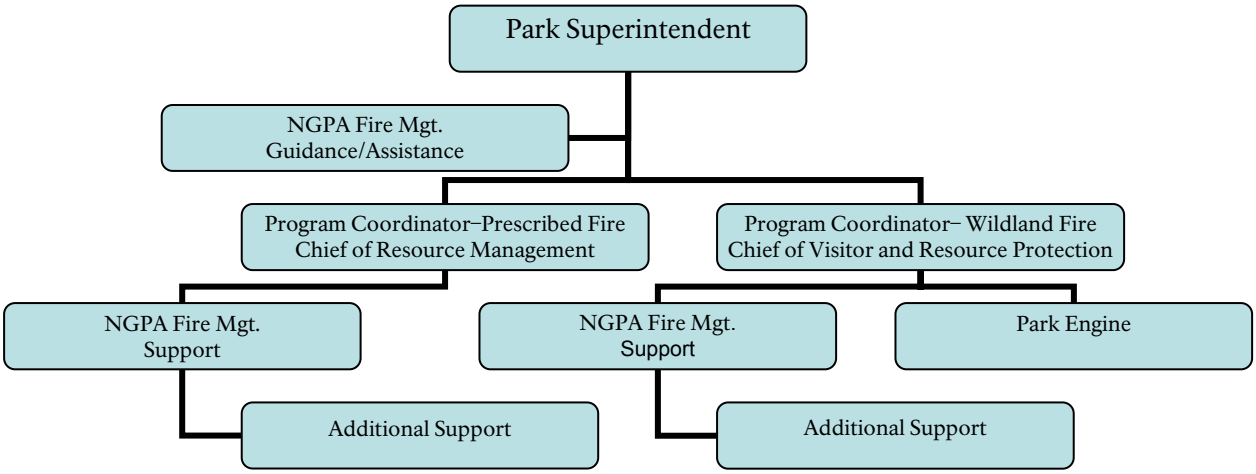
VI. Fire Management Organization and Responsibilities

A. Organizational Structure of the Monument's Fire Management Program

These key personnel are identified for fire management at DETO, including the staff at the Northern Great Plains Area Fire Management Office (NGPAFMO). NGPAFMO is a FIREPRO–funded National Park Service program office that provides guidance, technical support and coordination for national park units in the Northern Great Plains, containing Intermountain Region and Midwest Region parks. The sections below

delineate the chain of command, and describe responsibilities,. It also describes interagency roles and responsibilities for coordination and cooperation.

Figure 3 - Devils Tower Fire Management Organization



FIRE MANAGEMENT RESPONSIBILITIES:
While direct oversight of the Fire Management Program at DETO is a responsibility between the Chief Ranger and Chief of Resource Management, participation from all divisions is necessary to ensure all fire management activities are conducted safely and according to legal and policy constraints.
Individual roles and responsibilities for the Devils Tower Fire Management Program are as follows:

Superintendent*:*

- Responsible for overall operation and management of the park, ensures that Department, Service and park policies are maintained and followed.
- Secures funds and personnel needed to meet the objectives of the park's Fire Management Program.
- Responsible for overall fire prevention within the park.
- Approves decisions to manage wildland fires as a suppression incident.
- Signs Go/No Go checklist for each prescribed fire.
- Signs verification forms for fuel management activities.
- Ensures that all park divisions support the team effort to maintain a fire management program.
- Approves Fire Management Plan and all prescribed fire plans.
- Responsible for implementation of the Fire Management Plan.

- Serves as Fire Information Officer.

Fire Program Coordinator–Fire Suppression (Chief of Visitor and Resource Protection):

- Provides oversight for the park Wildland Fire Suppression Program.
- In coordination with the NGPAFMO, ensures that the fire management program complements resource management objectives and complies with NPS and interagency fire policy.
- Obtains input from technical experts for all fire planning.
- Ensures fire suppression activities are integrated with other emergency operations (law enforcement, search and rescue, structural fire protection) in the monument.
- Ensures training opportunities for monument fire personnel across all monument divisions based on identified monument needs and individuals' interest, and with supervisors' support.
- Supports the fire program by making personnel available for monument fire operations, out–of–monument fire assignments, and fire training to the extent possible.
- Assigns investigative resources to determine fire cause and pursue appropriate enforcement action when necessary for human–caused ignitions.
- Responsible for overall maintenance of fire cache, equipment and, wildland engine.
- Assists NGPAFMO in maintaining fire personnel files and all monument fire records; tracks training and fire experience

Fire Program Coordinator – Prescribed Fire (Chief of Resource Management):

- Provides oversight for the monument Prescribed Fire Program.
- In coordination with the NGPAFMO, ensures that the fire management program complements resource management objectives and complies with NPS and interagency fire policy.
- Coordinates the approval process for the Fire Management Plan including public scoping, internal and public review, and other National Environmental Policy Act (NEPA) compliance.
- Ensures that appropriate fire management activities are incorporated into the monument's GIS database.
- Ensures pre– and post–burn archeological surveys are conducted in areas of potential impact from planned fire management activities.
- Provides general oversight for monitoring and research programs designed to evaluate fire effects on resources, and uses feedback from technical experts to incorporate adaptive management.
- Ensures technical staffs for natural and cultural resources are trained to function in the Resource Advisor capacity.

- Obtains input from technical experts for all fire planning.
- Supports and encourages fire training and assignments for Resource Management staff, particularly higher–level skill positions.
- Supports the fire program by making personnel available for monument fire operations, out–of–monument fire assignments, and fire training to the extent possible.

Administrative Assistant:

- Completes travel documents for fire personnel from all monument divisions dispatched on assignment; maintains assignment log.
- Completes time recording for firefighters on monument fires, and submits to appropriate timekeepers for payroll purposes.
- Serves as dispatch for in–monument fire suppression activities.

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All fire qualified monument personnel will be subject to occasional fire duty. The order of preference shall be dependent on availability/response time, level of qualification, and complexity of fire assignment. Division Chiefs are also responsible for making a reasonable effort to provide qualified firefighting personnel from their staffs to assist with wildland and prescribed fire support efforts, both locally and nationally.

FIRE MANAGEMENT RESPONSIBILITIES: NORTHERN GREAT PLAINS AREA FIRE MANAGEMENT OFFICE

The Northern Great Plains Area Fire Management Office (located at Wind Cave National Park) was established to provide guidance and technical support for participating national park units (Wind Cave, Jewel Cave, Mount Rushmore, Devils Tower, Scotts Bluff, Agate Fossil Beds, and Badlands). The following are the key positions associated with this shared office and their responsibilities in the Devils Tower Management Program.

Fire Management Officer (FMO):

- Responsible for overall safety of the Fire Management Program.
- Coordinates fire management activities within the Northern Great Plains Area (NGPA), providing technical assistance and advice to parks as needed. Reviews and advises the Superintendent on requests for fire emergency assistance, operational activities required for the implementation of this Fire Management Plan, and completeness and correctness of all final fire reports.
- In cooperation with the Superintendent, is responsible for assisting and coordinating the park's fire management program. This responsibility includes coordination and supervision of all prevention, pre–suppression, detection, wildland fire use, prescribed fire, suppression, monitoring, and post–fire activities involving park lands. Submits budget requests and monitors FIREPRO funds allocated to DETO.
- Nominates personnel to receive fire–related training as appropriate.

- Coordinates the implementation of the Fire Management Plan with other governmental agencies administering adjacent lands and with local landowners. Develops and implements cooperative fire management agreements with other federal, state, and local agencies and with the local landowners.
- Coordinates, prioritizes, and submits all FIREPRO funding requests for fire program activities. Reviews all prescribed fire plans and Fire Reports (DI–1202).
- Approves Redcard and Task books (certifies).

Assistant Fire Management Officer (AFMO)/Prescribed Fire Specialist:

- In cooperation with the park Fire Program Coordinator and Fire Program Manager, develops short and long–range plans for prescribed fires. Is responsible to coordinate Prescribed Fire Plans for individual projects.
- Responsible for coordinating development of Prescribed Fire Plans for individual projects.
- Makes entries into NFPORS database for prescribed fire and fuels treatment planning.
- Coordinates preparation and implementation of prescribed fire and fuels treatment projects.
- Supervises Black Hills Fire Use Module

Assistant Fire Management Officer (AFMO)/Training and Suppression:

- Serves as Safety Officer for the Fire Management Program.
- Ensures all park fire weather equipment is operable and performs required cyclic maintenance on the stations.
- Coordinates annual firefighter refreshers.
- Develop, coordinate and conduct fire training as necessary to meet wildland fire needs of the park according to approved Fire Management Plan and local and national guidelines.
- Coordinates Fire Preparedness Reviews and site reviews.

Fire Ecologist:

- Analyze and interpret fire effects data and report findings to Park Superintendent and fire staff.
- Manage fire effects database (monitoring plot database, spatial data, photographic images).
- Assists with describing monitoring types and developing prescribed fire objectives.
- Coordinates fire–related research.
- Assists with writing various management plans and compliance documents; helps ensure ecological implications of fire are included in all park planning.

Lead Fire Monitor:

- Responsible for implementing the park's Fire Monitoring Plan and descriptions of monitoring types.
- Responsible for all standard (NPS Fire Monitoring Handbook, 2001) fire effects monitoring activities in the park; will coordinate with the Fire Program Coordinator and Fire Effects Liaison.

Fire Program Assistant:

- Provides technical and administrative support for the Area Fire Management Officer and all parks within the Northern Great Plains Area. Will assist with dispatching and mobilization activities.
- Collects and records daily fire weather observations and ensures they are entered into the Weather Information Management System (WIMS).
- Maintains records for all personnel involved in suppression and prescribed fire activities, detailing the individuals' qualifications and certifications for such activities.
- Updates all fire qualifications for entry into the DOI Shared Applications Computer System (SACS).

B. FIREPRO Funding

FIREPRO is the mechanism for funding requests and resource allocations for the NPS fire management program. The Northern Great Plains Area Fire Management Officer manages all FIREPRO funding for the monument. Funding is available for engine maintenance, personal protective equipment, and training on an as–needed and available basis.

C. Fire Management Organization in Relation to Monument Organization

The Northern Great Plains Fire Management Officer is the point person for fire management at the monument. This entails coordinating with the monument personnel, Midwest Region, and Fire Management Program Center staff.

D. Interagency Coordination

A statewide Interagency Cooperative Fire Management Agreement exists among the National Park Service, U.S. Forest Service, Wyoming State Division of Forestry, local fire departments. The National Agreement between the U.S. Departments of the Interior and Agriculture also serves as an umbrella agreement for interagency assistance. Closest forces for initial attack are from the US Forest Service, Black Hills National Forest. Bearlodge Ranger District. DETO maintains close coordination with the Northern Great Plains Fire Management Office in Wind Cave National Park and the Area FMO at that office through an Interpark Agreement.

From an interagency standpoint, DETO is situated in the Rocky Mountain Geographic Area. Coordination for resource orders for in–park needs and out–of–park needs are served through the following logistical support sequence:

Figure 4. RESOURCE ORDER LOGISTICAL SUPPORT SEQUENCE

The Northern Great Plains Interagency Dispatch Center, located at the Rapid City Airport (former terminal building) provides the primary wildland fire dispatching function for DETO. The Northern Great Plains Area Fire Management Office compiles weekly availability of DETO resources during fire season. This availability list is then provided to the Interagency Dispatch Center. Procedures for requesting assistance are found in the Rocky Mountain Interagency Mobilization Guide, published annually, and the Mobilization Guide for the Northern Great Plains Area.

E. Key Interagency Contacts

Chief, Hulett Volunteer Fire Department.

Fire Management Officer, Black Hills National Forest.

Forester, Division of Forestry, State of South Dakota

Forester, Division of Forestry, State of Wyoming

F. Fire Related Agreements

Copies of the following documents are on file in the Northern Great Plains Area Fire Management Office:

- Agreement on Fire Management Operations Between DETO, Midwest Region and the Intermountain Region
- Inter–park Agreement Between Northern Great Plains Fire Management Office and Agate Fossil Beds National Monument, Badlands National Park, Devils Tower National Monument, Jewel Cave National Park, Mount Rushmore National Memorial, Scotts Bluff National Monument, and Wind Cave National Park.
- Interagency Cooperative Fire Management Agreement among the BLM, NPS, BIA, USF&WS, USFS, and the State of South Dakota.
- Cooperative Fire Suppression Agreement between Devils Tower and Hulett Volunteer Fire Department
- Interagency Cooperative Fire Protection Agreement between Black Hills National Forest,, Devils Tower National Monument, Mount Rushmore National Memorial, Jewel Cave National Monument, and Wind Cave National Park
- Various national agreements can be found in the National Mobilization Guide

VII. Fire Research

A fire history study conducted at the monument showed the intervals between fires falls into three groups: pre–1770, 1770–1900, and 1900 to 1983 (Fisher et al. 1987). Pre–1770 conditions had a 15 to 27–year return period of fire. From 1770 to 1900 fire frequency increased to 8–14 years between fires. This increase is likely due to use of fire by American Indians and the occupation of the area by Europeans. After 1900, fire return period lengthened to 28–42 years due to active suppression of all wildfires. According to Fisher, this suppression has resulted in a decrease in prairie area, savannas becoming dense forests, and an increase in fuel loads in all fuel types. Fisher also states the abnormal increase in fuel loads means that under certain conditions a wildfire in the monument could completely destroy the savannas and forests.

Additional research is needed to identify methods to more effectively use fire to reestablish the native mixed prairie and reduce exotic species. Specific studies should be undertaken to determine effects of prescribed fire on water quality, riparian vegetation, erosion rates, and bird habitat.

Implementation of the monument's Wildland Fire Management Plan should not be contingent on completion of research concerning the fire regime and fire effects on vegetation. A large body of scientific information on the effects of fire and fire exclusion in areas similar to the monument already exists.

There is limited funding available for fire research, but if it is determined that more data is critical, managers may submit requests through the annual FIREPRO budget call. Additionally, requests for research funding may be made through the Interagency Joint

Fire Science Group.

VIII. Monitoring

A. Monitoring Requirements

A fire effects monitoring program at the monument began in 1996 and will continue in conjunction with the prescribed fire program. Monitoring focuses on native grass, shrubs, herbs, and trees. Evaluation and interpretation of fire effects monitoring is the joint responsibility of fire and resource management personnel. Interpretation of monitoring results will then influence management decisions.

Long–term monitoring includes the installation of permanent plots to determine the effects of prescribed fire. Long–term monitoring also determines whether or not resource management objectives are being achieved, such as percent change in grass cover, fuel load, stand structure, species richness, shrub density, and native versus nonnative relative cover.

Short–term monitoring follows the procedures and protocols established in the NPS *Fire Monitoring Handbook*. Short–term monitoring also determines if prescribed fire unit objectives have been achieved, such as tree and shrub mortality and fuel reduction.

B. Fire Monitoring Handbook

All prescribed fire monitoring activities at the monument will follow guidelines in the NPS *Fire Monitoring Handbook*. Permanent photo points will be established to supplement the handbook.

All prescribed fires must include an adequate number of prescribed fire monitors to record site weather, smoke dispersal, and fire behavior and to collect data from *Fire Monitoring Handbook* plots in the prescribed fire unit. A prescribed fire monitoring report that includes weather observations, fire behavior observations, ignition pattern, and immediate post fire effects will be completed for each prescribed fire. Monitoring critiques will be held after prescribed fires have been completed.

C. Fire Monitoring Plan

See appendix F.

IX. Public Safety

A. Public Safety Issues

Wildland and prescribed fires can be hazardous for firefighters, employees, and the visiting public. Private and monument developments are also at risk from wildfire. The safety of all people and developments in the area are the foremost concern of the incident commander and/or prescribed fire burn boss. Escape routes and safety zones will be identified. In extreme situations the superintendent may close the monument and order its evacuation.

B. Safety Procedures

The entire perimeter of a wildfire can usually be easily monitored, and there is little likelihood that the fire will spread far. The public should be kept out of the fire area and should be far enough away that they will not hinder the suppression activities. No one will be permitted near a fire without adequate training and personal protective equipment.

In the case of a wildland fire that has potential for rapid spread, monument visitors could be in dangerous areas. Visitors will be informed about the fire at the monument entrance and at the visitor center and will be advised about areas where caution should be exercised. Monument visitors and neighbors will be told of any fire activity that may become threatening and will be taught safety measures.

Temporary closure of all or part of the monument may be necessary when fire could endanger visitor and employee safety. When a fire threatens to escape from the monument, adjacent authorities will be given as much advance notice as possible in order to take action.

In extreme situations where the rate of spread constitutes an immediate threat, all efforts should be made to inform and evacuate all threatened parties as quickly as possible.

Signs will be placed at each trailhead warning hikers when a prescribed fire is in progress. Warning signs will be placed on the roads if smoke creates a safety hazard. Roads will be closed if visibility is significantly impaired.

X. Public Information and Education

A. Public Fire Information Capabilities and Needs

An informed public can provide support for the fire management program at the

monument and aid in fostering its goals. A concerted effort by the monument staff will be made to raise public awareness of fire concerns, including fire prevention messages. Fire danger indices will be publicized when they are high or extreme, and ongoing fires will be carefully explained. Fire management messages will be introduced into interpretive programs as appropriate. The monument may participate in fire prevention and education activities in the community in conjunction with neighboring fire departments. Visitors will be made aware of fire restrictions and closures in and around the monument. High fire danger notices will be posted at the visitor center. Local media will be informed of fire prevention and education concerns through news releases. Media access to fire scenes will be facilitated when it is safe to do so. When interest is warranted, the superintendent will be designated as the contact person for all information requests.

B. Step–Up Plan Information Actions

Refer to Section IV, C, 2.e of this plan.

XI. PROTECTION OF SENSITIVE RESOURCES

A. Archeological Sites

A 1997–98 100% survey of the monument found 21 historic and 49 prehistoric archeological sites (Molyneaux 1998). Historic sites consist of the old park entrance road, homestead site, trails, trading post and cabins and graffiti. All prehistoric sites are open, lithic scatters with the exception of two rock paintings and a hearth. All of the National Register eligible sites found to be at risk from a prescribed fire will be protected through reducing and protecting fuels on a site, excluding a site from the area to be burned and avoiding ground disturbance. These protection measures will be subject to agreement between the NPS and Wyoming State Historic Preservation Office. All unrecorded sites that are discovered during a fire activity will be recorded and protected.

B. Sensitive Natural Resources

The Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) requires an examination of impacts on all federally listed threatened or endangered species. National Park Service policy also requires examination of the impacts on federal candidate species

This plan and an environmental assessment will be submitted to the U.S. Fish and Wildlife Service, and necessary consultation will be conducted.

There are 6 plant species, however, that are considered species of special concern by the Wyoming Natural Diversity Database of the Nature Conservancy (Fertig 2000).

C. Infrastructure and Developments

Accepted interagency urban interface wildland fire risk mitigation techniques should be applied to prevent or reduce negative impacts to improvements, developments, structures and other identified values at risk. These techniques may include, but are not limited to, hazard fuel removal, improvement of fire engine accessibility, removal or replacement of burnable materials on or near structures.

XII. Fire Critiques and Annual Plan Reviews

A. Critiques

All fires in the monument will receive, at a minimum, a review by those involved to evaluate such topics as: the initial response, "hotline" (on–going fire incident) review, control methods used, safety concerns, and the need for new and replacement equipment. This review will be conducted by the incident commander, prescribed fire burn boss, Fire Management Officer, or the official who has designated fire program responsibilities. The purpose of this review is to recognize and document actions that were successful and to identify and rectify actions that were unsafe or ineffective.

The superintendent will conduct closeout meetings with incident management teams to ensure a successful transition of incident command back to the monument staff and to identify and evaluate incomplete fire business. Refer to *Reference Manual* 18, Chapter 13, Exhibit 1 for a sample incident management team closeout.

A regional or national level fire review may be conducted if the fire:

- crossed the monument boundary into another jurisdiction without the approval of landowner or agency
- resulted in adverse media attention
- involved serious injury or death, significant property damage, or had the potential to do so
- resulted in controversy involving another agency or landowner

Refer to *Reference Manual* 18 Chapter 13, Exhibits 2 & 3.

All entrapments and fire shelter deployments will be reported and investigated as soon as possible after the incident. Refer to *Reference Manual* 18 Chapter 13, Exhibit 4 & 5 for review directions and a written outline format.

B. Plan Reviews

An informal fire management program review will be conducted annually to evaluate current procedures and identify any needed changes to the *Fire Management Plan*. A

formal fire management review will be conducted every 5 years. The superintendent must approve significant changes to the body of this plan. The only exceptions to this procedure will include: grammatical corrections, minor procedural changes, and deletions, corrections, and additions to the Appendix. Copies of all changes will be forwarded to the Northern Great Plains Area Fire Management Officer who will forward them to the Midwest Regional Fire Management Office. Changes requiring approval and concurrence will be submitted with a replacement cover sheet for signature. Changes are subject to NEPA and may require an additional compliance document.

XIII. Consultation And Coordination

A. Agencies Consulted

Wyoming State Air Quality Office

Hulett Volunteer Fire Protection District

U.S. Fish and Wildlife Service

Black Hills National Forest

B. Persons Consulted

Devils Tower National Monument

Lisa Eckert, Superintendent
Jim Cheatham, Chief of Resource Management
Scott Brown, Chief of Visitor and Resource Protection

Northern Great Plains Area Fire Management Office

Doug Alexander, Fire Management Officer, Northern Great Plains Area Parks
Bill Gabbert, former Fire Management Officer
Cody Wienk, Fire Ecologist
Dan Morford, Assistant Fire Management Officer
Andy Thorstenson, Fire Monitoring Team Leader

Others Assisting

Fred Bird, Fire Management Officer, NPS Midwest Region
Jim Decoster, Fire Ecologist, NPS Midwest Region
Monte Neiman, Chief, Hulett Volunteer Fire Department

XIV. Appendices

Appendix A – References

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Appendix B – Definitions

CURRENT TERMS: (Adopted By National Wildland fire Coordinating Group 6/12/97)

Wildland Fire – Any nonstructural fire, other than prescribed fire, that occurs in the wildland.

Fire Management Plan – A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational procedures such as preparedness plans, planned dispatch plans, prescribed fire plans and prevention plan.

Preparedness – Activities that lead to a safe, efficient, and cost effective fire management program in support of land and resource management objectives through appropriate planning and coordination.

Prescription – Measurable criteria, which guide selection of, appropriate management response and actions. Prescription criteria may include safety, economic, public health, environmental, geographic administrative and social or legal consideration.

Appropriate Management Response – Specific action taken in response to a wildland fire to implement protection and fire use objectives.

Prescribed Fire – Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements must be met prior to ignition.

Initial Attack – An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Wildland Fire Situation Analysis – A decision–making process that evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives as selection criteria.

"Park" and "Monument" are used interchangeably in this document.

OBSOLETE TERMS

Many traditional terms have either been omitted or made obsolete by the policy. The terms listed here have uses or connotations that are contrary to the new policy.

Presuppression –The term "presuppression" has been replaced by the term

"preparedness" to match policy and appropriation language.

Prescribed Natural Fire

Management Ignited Prescribed Fire

Escaped Fire Situation Analysis – This term is replaced by Wildland Fire Situation Analysis

Confine/Contain/Control – These terms, when used in the context of suppression strategies, are confusing since they also have tactical meanings. Containment and control are assumed to maintain their definition for fire reporting purposes.

Appendix C – Species List

VEGETATION:

The following list is a summary of the vegetation community types identified at the monument.

Grass/Forb:
Sedge/Cat–tail/Bulrush is a semi–permanently flooded herbaceous alliance associated with water.

Little Bluestem/Grama Grass (Sideoats, Blue) is typically found on sparse to barren gravelly slopes and knolls.

Western Wheatgrass represents the majority of the native grass communities in the monument. Included in this class are the Western Wheatgrass/Green Needle Grass community and the Western Wheatgrass/Needle–and–Thread community.

Kentucky Bluegrass/Smooth Brome/Intermediate wheatgrass is an introduced herbaceous alliance. The Smooth Brome and intermediate wheatgrass appear to be restricted to road right–of–ways, heavily disturbed areas, and agricultural fields. Kentucky Bluegrass occurs in a majority of the grassy areas throughout the monument, particularly drainages, swales, and gentle slopes.

Blue Grama occurs sparingly throughout the monument, increasing towards the northeast corner of the monument where it occurs on cobbled, broad benches. This class likely occurs as a result of increased grazing pressure and/or a reduction in ground moisture.

Shrub:
Mountain Mahogany/Sideoats grama shrubland is present along steep, sparse slopes especially throughout the Red Valley in the southeast corner of the monument. Ponderosa Pine is present in and around this class although some sparse Rocky Mountain juniper may occur in drainages.

Leadplant occurs on some of the grassy slopes and knolls throughout the monument. Three–leaved Sumac/Chokecherry occurs throughout the project area on mesic slopes and drainages, along draws and deep swales, and on rather rocky soils.

Willow species represents a very limited riparian shrubland community that exists along perennial waterways.

Western Snowberry is extremely common throughout the monument in mesic swales,

draws, and drainages.

Tree:
Cottonwood occurs exclusively along the Belle Fourche River and some of the major drainages. The understory is likely composed of various shrubs and grasses including Snowberry, Chokecherry, and Western Wheatgrass.

Boxelder/Chokecherry is common along the perennial streams in the monument.

Green Ash is extremely rare in the monument.

Quaking Aspen/Paper Birch is rare and is restricted to northern–forested uplands. Whereas the other deciduous types are restricted to floodplains and riparian corridors, aspen and birch stands occur on slopes, benches, valley bottoms, and along the margins of floodplains.

Ponderosa Pine includes all forested areas with a probable Ponderosa Pine crown density of 80–100. Ponderosa Pine/Little Bluestem forested areas with a probable crown density of less than 80%. This semi–open to open canopy allows sufficient light to penetrate which supports an understory of grasses and sparse shrubs. Gravel and silty sand soil compositions will typically support Little Bluestem, whereas loamy soils should favor Western Wheatgrass.
Ponderosa Pine/Chokecherry occurs along mesic margins of the Ponderosa Pine classes and adjacent to draws and drainages. This is an ecotone usually representing a transition from woodland to grassland with Chokecherry present in dense clumps. Ponderosa Pine/Mixed herbaceous class includes all forested areas with a probable ponderosa crown density of less than 80%. This semi–open to open canopy allows sufficient light to penetrate which supports an understory of grasses, mainly Western Wheatgrass. This class is usually found in areas where the Ponderosa Pine has encroached onto deep loamy soils.
Ponderosa Pine young age class, which includes all areas that have been recently re–forested by Ponderosa Pine (roughly <20 years old). The pine usually forms large, dense (dog–hair) stands next to older pine classes and /or burnt areas.

FIRE EFFECTS BY SPECIES:

Researchers are in agreement that fire provides an overall benefit to the continued growth, health, and maintenance of the mixed grass prairie ecosystem. (Vogl 1979, Wright and Bailey 1980). And although there appears to be some conflict in research findings relative to whether fire benefits or harms particular species (and the degree of benefit or harm resulting to affected species), there is essential agreement that for the mixed grass prairie fire plays an integral role in maintaining the ecosystem.

Given the rapid growth characteristics and the chemical composition of most mixed–grassland species, decomposition occurs slowly in the absence of fire in this ecosystem. Fires thus remove stagnant, dead plant accumulations while converting that mass to ash and charcoal. The blackened, burned areas protect underlying soils by joining remaining unburned vegetation and charcoal bits and helps to raise the soil temperature by several degrees, particularly in the spring. The ash/charcoal material returns a number of minerals and salts to the soil, thus recycling them for new plant growth. More importantly, the higher temperatures increase fungal, bacterial, and algal activity, which in turn increases available nitrogen. The increased microorganism activity also helps to increase soil temperatures while aiding in nutrient recycling. Fire generally improves mixed–grassland soils without leading to increased erosion.

In general, fires tend to stimulate plant growth, resulting in larger, more vigorous plants, greater seed production, and increased protein and carbohydrate contents. Herbivores prefer post–fire vegetation because it is more palatable and nutritious. When fires burn in mosaic patterns, potential animal cover remains while vegetation increases. Fires tend to increase species diversity, and reduce woody species relative to grass and forb species. (Vogl 1979, Wright and Bailey 1980).

Research data relative to fire's effects on a great number of mixed–grassland vegetation species are lacking. However, there are some data available for some species. It must be restated that some data seem to be in conflict. This may result from the type of fire (wildland fire vs. prescribed fire), season of fire (spring, summer, fall, winter); climatic conditions (lightning fires accompanied by rain vs. lightning starts during drought conditions); area of study (monument or monument–type lands vs. similar lands located further from the monument); and research methods used. Thus, data summarized here can serve as only general guides for expected effects of fire on a particular species. It is imperative that as part of the overall fire management program, site specific/species specific monitoring be conducted and observations permanently recorded in order that more accurate conclusions can be drawn as to the best method of returning the monument to a more natural fire regime and the result of using prescribed fires to aid the return to and continuation of that natural regime.

EXISTING FINDINGS PERTINENT TO FIRE MANAGEMENT OF SEVERAL PLANT AND ANIMAL SPECIES FOUND IN THE MONUMENT INCLUDE:

Western Wheatgrass (*Agropyron smithii*)— Herbage yield reduced for up to three years following wildland fire and prescribed fire in semi–arid mixed prairie; remained the same or increased following May, September, and August wildland fires, though herbage yield may be reduced in mesic mixed prairie; increases found following prescribed fires in April and March with some decrease following late May prescribed fire. There was also a decline noted in unburned areas (Wright and Bailey 1980). Near Miles City, Montana, another study of prescribed fire results showed the amount

produced substantially lower following early spring burning versus fall burning (but both higher than on unburned control plots) although yields similar by the following spring. June yields were greater on burned plots versus unburned, control plots. Soil moisture found to have strong influence. Forage production may or may not be increased where this species is dominant. The time of year measurements are taken can vary findings substantially (White and Currie, 1983).

Little Bluestem (*Andropogon scoparius*)—Data from fires in the forest–grass ecotone in the Black Hills area indicate that burning in the spring to late spring promoted an increased production by this species. Conversely, a late winter/early spring prescribed fire (early March) resulted in severe harm to little bluestem. The conclusion drawn was that late spring fires under normal to above average moisture conditions are useful to increase yields of this species. Other spring fires in the eastern edge of the mesic mixed prairie had similar results (Wright and Bailey 1980). For comparison, data exist to show that fires in dry years in the southern Great Plains can greatly decrease yields while fires in wet years can greatly increase the yields. Similar results were found following wildland fires in the central Great Plains in both the mixed grass and tall grass prairies. The key seems to be to conduct the prescribed fires in the late spring in years of at least average moisture conditions to get an increase of this species (Wright and Bailey 1980).

Blue Grama (*Bouteloua gracilis*)—Some reduction of yield resulting from a spring fire, with full recovery by the third following year in a semi–arid mixed prairie locale; frequency reduced following late–May and fall wildland fires in a mesic mixed prairie setting; although with early spring fires increases were found (Wright and Bailey 1980). Another study near Miles City, Montana revealed that using prescribed fire, Blue Grama yields were reduced early in the growing season and increased in late summer. However, results differed between this study and those following wildland fires. Probably, by reduction of other competing species, Blue Grama had its highest herbage yield following spring prescribed fires (although better reduction of the other competing species may be greater using fall prescribed fires).

Upland sedges [Threadleaf and Sun] (*Carex* spp.)—Sedges generally tolerate fire very well. The season of a fire has the greatest effect on these plants (Wright 1978). For the Threadleaf Sedge, (*Carex filifolia*), a low precipitation after a fire may delay full recovery until postfire year 2 or 3 or longer, depending on the severity of the fire. In South Dakota, productivity was increased by burning in April and October when precipitation was above average but was reduced when precipitation was low after the fire (Whisenant and Uresk 1989). To maintain a good stand, plants should not be burned during period of drought, and fire severity should be light to moderate (Brand 1980). Therefore, if postfire precipitation is adequate, it appears that light–moderate severity fires (particularly spring fires) often cause only minimal damage to Threadleaf Sedge. The Sun Sedge (*Carex heliophila*) is important forage at the beginning of the grazing season and after summer rains. In South Dakota and Wyoming, the Ponderosa Pine/Sun Sedge habitat type is uses as a spring–fall range for livestock and spring–summer range

for large mammals (Hermann 1970). Although summer grass fires harm warm–season species, they favor cool–season ones like Sun Sedge.

Needle–and–Thread Grass (*Stipa comata*)—Needle–and–Thread is severely damaged by fire. This grass is generally killed when aboveground vegetation is consumed by fire. Fire effects depend on the season of prescribed fire and phenology, as well as on fire intensity and severity. Site conditions and climatic factors can also play a significant role. Needlegrasses are among the least fire resistant of the bunchgrasses (Young, Evans, and Major 1977). This species begins growth in the spring or early summer and lacks the pronounced dormant period in late summer that is typical of many other grasses. Consequently, fire is most injurious in midsummer and least detrimental in late spring or fall (Volland and Dell 1981).

Green Needle Grass (*Stipa viridula*)—Specific effects of fire depend on the season of prescribed fire, phenology, size of individual plants, and fire intensity and severity. During some high–severity fires, heat may be transferred below the soil surface by the foliage of Green Needlegrass, thereby increasing the amount of damage the plant receives. Needlegrasses often exhibit subsurface charring. In general, Green Needlegrass plants with a lower ratio of dead to living plant material and less fuel volume generally respond more favorably to fire than larger plants do (Wright and Klemmedson 1965).

Japanese Brome (*Bromus japonicus*)—Except in wet years, fire tends to reduce Japanese Brome (non–native) populations. The reduction usually lasts for only 1 or 2 years (Gartner and White 1986). Some seed is killed by fire, but seedbank reserves, reproductive capacity, and competitive ability of Japanese Brome are usually sufficient to allow for re–population of an area within 2 years unless the site is reburned (Whisenant 1985). Since litter accumulations are more critical for germination and seedling establishment when precipitation is low, drastic population reductions can be expected when burning is followed by below–average precipitation (Whisenant 1990). Kirsch and Kruse (Kirsch and Kruse 1973) hypothesized that the successful establishment and spread of Japanese Brome across the Northern Great Plains is a direct result of fire suppression: the resulting thicker surface mulch created a more mesic microenvironment for seeds and seedlings (Kirsch and Kruse 1973). Japanese Brome populations will probably continue to increase in the absence of fire (Whisenant 1990). However, he cautions managers to balance the benefits of litter against the need to reduce Japanese Brome when preparing fire management plans. Benefits of litter include soil stabilization and insulation, moisture retention, and promotion of perennials (Vogl 1974).

Smooth Brome (*Bromus inermis*)—Smooth Brome is a cool season exotic that is especially troublesome in disturbed portions of old pastures in the tallgrass and mixed prairie regions. Although less invasive than Kentucky Bluegrass, with which it often occurs and is managed, it is also less responsive to management. The optimal timing for

control of Smooth Brome by burning appears to be in boot stage, which may be as early as mid–April in the central Great Plains or in the northern plains. Early spring (late March–April) or late–season (late summer–fall) fire can increase Smooth Brome productivity (Higgins, Kruse, Piehl 1989 and Hughes 1985) especially when Smooth Brome has become sod–bound. Late spring fire generally damages cool–season grasses such as Smooth Brome (Bailey 1978 and Masters, Vogel 1989). Old, Kirsch and Kruse, and Blankespoor have reported reductions in Smooth Brome with late spring burning. Blankespoor and Larson's 1994 prescribed fire–water treatment study suggests that prescribed late spring fire will most effectively control Smooth Brome in wet years. They recommend continuing a program of prescribed fire through drier years, however. Since they found that Smooth Brome increased in importance without burning, and that increases were greatest when initial Smooth Brome biomass was low, they concluded that failing to burn Smooth Brome in dry years is likely to accelerated its expansion.

Downy Brome/Cheatgrass (*Bromus tectorum*)—This non–native grass is not appreciably affected by burning although production may be reduced the first year. The earlier the fire, the greater the degree of reduction (Stewart and Hull 1949). Fires in pure Cheatgrass stands tend to be less common in the spring or early summer. Fires generally occur in the summer after seed is shed and is less vulnerable to burning. Reduction of Cheatgrass under these conditions is not great (Tisdale and Hironaka 1981). Fire reduces cured plants to ash, but fire intensity may not be great enough to consume the litter layer, even if associated shrubs burn. Since Cheatgrass produces prolific quantities of seed, even a large reduction in the seed pool will not prevent it from regaining dominance on a site (Young, Evans, and Weaver 1976). Must be cautious with this non–native grass because early summer fires can also kill perennial grasses and facilitate increases in Cheatgrass.

Kentucky Bluegrass (*Poa pratensis*)— There is some disagreement whether Poa pratensis is native in the northern tier of states and Canada (Fernald 1950, Great Plains Flora Assoc 1986, Gleason and Cronquist 1953) or native in Eurasia and introduced throughout its North American range (Hitchcock 1950, Mohlenbrock 1972, USDA 1948). This species is a major problem throughout the tallgrass and mixed grass prairies. In natural areas it competes with native species, reducing species diversity and altering the natural floristic composition. In northern mixed prairie (north of Nebraska sandhills) Poa is believed to compete directly with cool season native grasses (Steuter pers. comm.). North of the Nebraska sandhills in the Dakotas, there is a more even mix of native warm and cool season grasses (Steuter pers. comm.). There is only a short period of one or two weeks between the greening–up of Poa and of native co–dominant Stipa species. Unless fires are timed exactly within this spring period, the advantage of controlling Poa will be offset by damage to native cool season grasses. Results from a study by Schacht and Stubbendieck (1985) in Nebraska suggest that it is not only spring injury to Poa, but the shift of competitive advantage to warm season natives that makes fire an effective tool for range conversion in mixed prairie. Because natural area management goals involve the replacement of Poa by native species, it is important to

monitor not only the decrease in Poa, but also the increase or retention of desired native species. This is important because under sod–bound conditions Poa could decrease without any benefit to native species (Kruse pers. comm, Volland pers. comm.).

Canada Thistle (*Cirsium arvense*)—Canada thistle is a herbaceous perennial in the aster family. It is an exotic weed that was introduced to the U.S., probably by accident, in the early 1600s and by 1954, had been declared a noxious weed in 43 states. In Canada and the U.S., it is considered one of the most tenacious and economically important agricultural weeds, but only in recent years has it been recognized as a problem in natural areas. To keep this weed from expanding its range you must eliminate or control, to the greatest extent possible, seed production. Complete control is difficult because of the perennial root system, abundant seed production, and widespread and diverse habitat of the plant. The key is to integrate prescribed fire with the biological control program (begun in 1992) and mowing efforts that are being conducted at the monument.

Prescribed spring fires may be a useful means of slowing the spread of Canada Thistle. Spring fire would reduce the number of mature plants. They would also reduce the number of functional flower heads, resulting in lower seed production and a slow–down in the spread of new plants. Dormant–season fire is also beneficial to many native grass species, would interfere with Canada Thistle growth and reproduction, and possibly its spread (Young 1986). Patches of Canada Thistle were reduced in Minnesota after 4 years of consecutive spring burning of low to moderate intensity (Becker 1989). Density and aboveground biomass were unchanged after a spring fire (May, before growth began) and increased after both summer (August, peak of growth) and fall (October, winter dormancy) fires in Manitoba. The increase on the fall fire was lower than on the summer fire (Thompson and Shay 1989).

Leafy Spurge (*Euphorbia esula*)—Leafy Spurge is a competitive and widespread perennial weed on rangeland in the northern Great Plains. This non–native weed threatens native grassland communities by displacing native species, thereby reducing native plant and animal diversity. Leistritz et al. (1992) estimated the annual regional net economic impact from Leafy Spurge infestations to be about $75 million when impacts on ranch incomes and regional economies are considered. If manually pulling of plants proves ineffective then fire and herbicides may be considered.

The literature reports varying responses of Leafy Spurge to spring burning. It was reported to increase, decrease, and show no change (Kruse and Higgins 1990). Fall burning (September 30) resulted in a decrease in frequency, from 17 to 0 percent, in western North Dakota (Dix 1960). Frequency was also reduced 4 years after a fall prescribed fire on a mixed–grass prairie (Wright and Thompson 1978). Fall burning may be an effective means of controlling Leafy Spurge (Dix 1960, Evans and Heitlinger 1984, Wright and Thompson 1978). Fire has been less effective than herbicide treatments (Biesboer and Koukkari 1990) but should be considered in areas where herbicides are

too expensive or where there is concern due to the environmental impacts of herbicides. Prescribed fire does have some benefits for a complete management program. Prescribed fire can increase visibility of Leafy Spurge plants and improve detection of small plants and seedlings, especially in wooded areas (Lym and Zollinger 1995).

True Mountain Mahogany (*Cercocarpus montanus*) Deer and elk consume the leaves and twigs in the summer and browse the twigs in winter. Mountain Mahogany is considered highly palatable forage. New spring foliage is preferred by livestock and wildlife and remains palatable until late fall. The palatability of Mountain Mahogany to wildlife is rated as follows: Good for Elk/Mule Deer/Small mammals in Wyoming and good for Elk/Mule Deer in Colorado (Stanton 1974). Fire generally top kills Mountain Mahogany (Pase and Lindenmuth 1971). Mountain Mahogany sprouts vigorously after fire. Mountain Mahogany sprouted after severe fire in Bandelier National monument, New Mexico (Potter and Foxx 1979). Mountain Mahogany seedlings may establish after fire, although seedling establishment may be relatively low (Pase and Lindenmuth 1971). The response to True Mountain Mahogany to fire may vary seasonally. High and low severity fire treatments applied during the dormant season in north–central Colorado were more effective increasing biomass production than those applied during the growing season (Young and Bailey 1975).

Bur Oak (*Quercus macrocarpa*) —Bur Oak is generally favored by fire (Daubenmire 1936, Hoffman and Alexander 1987). In many locations, unless fire or other disturbance occurs, the Bur Oak seedlings are unable to compete with more shade–tolerant species (Reichman 1987). On some sites in the Black Hills, Bur Oak sprouts may compete well with Ponderosa Pine seedlings (*Pinus ponderosa*), and pine encroachment of the burned–over area is often very slow (Hoffman and Alexander 1987).

Quaking Aspen (*Populus tremuloides*)—Quaking Aspen is able to naturally regenerate without fire or cutting on some sites (Perala 1990), but fire may be required for regeneration on others. There are areas in Jackson Hole, Wyoming, where ungulate browsing has been light, both historically and recently, yet stems have not attained tree size since extensive fires in the 1880's (Gruell and Loope 1974). Prescribe fire is recommended for Quaking Aspen (Brown, Booth and Simmerman 1989). Quaking Aspen generally sprouts vigorously after fire. Long–term growth and survival of Quaking Aspen sprouts depend on a variety of factors including pre–fire carbohydrate levels in roots, sprouting ability of the clones(s), fire severity, and season of fire. Moderate–severity fire generally results in dense sprouting. Fewer sprouts may be produced after severe fire (Brats and Mueller 1979). Small–diameter Quaking Aspen is usually top–killed by low–severity surface fire (Jones and Debbie 1985). As diameter–breast–height increases surface beyond 6 inches (15 cm), quaking aspen becomes increasingly resistant to fire mortality. Large Quaking Aspen may survive low–severity surface fire, but usually shows fire damage (Brown and Debyle 1989). Moderate–severity surface fire top kills most Quaking Aspen, although large–stemmed trees may survive. Severe fire top kills Quaking Aspen of all size classes.

Ponderosa Pine (*Pinus ponderosa*)—Interior Ponderosa Pine depends on frequent surface fires to maintain stand health and stability (Biswell, Kallander and Komarek 1973). Fire exclusion has profoundly influenced the stability of interior Ponderosa Pine stands (Cooper 1960). The following management problems are associated with reduced fire frequencies: 1) overstocked sapling patches 2) reduced growth 3) stagnated nutrient cycles 4) increased disease, insect infestations, and parasites 5) decreased seedling establishment 6) increased fuel loadings 7) increased vertical fuel continuity due to dense sapling patches 8) increased severity and destructive potential of wildland fires (Covington and Sackett 1984). The effect of fire on interior Ponderosa Pine is generally related to tree size, fire intensity, and tree density (Alexander 1987). Low intensity fires readily kill seedlings less than 12 inches in height (Biswell, Kallander and Komarek 1973). Larger interior Ponderosa Pine seedlings can sometimes survive heat generated by low intensity surface fires, especially dormant season fires (Fischer and Clayton 1983). Larger seedlings, saplings, and pole–sized trees are damaged but not killed by low intensity fires. Beyond the pole stage, interior Ponderosa Pine is quite resistant to the majority of ground fires (Schuber, Heidmann and Larson 1970). For the season of fire: Interior Ponderosa Pine usually survives fires during the dormant season, largely because insulating scales form once leader growth stops (Ryan 1982) and because dormant season fires are usually relatively cool (Dieterich 1979). Trees are least resistant to thermal damage during early spring and most resistant in the fall when dormant (Hare 1961). Trees can withstand up to 50 percent crown scorch from fall burning but only 30 percent crown scorch from spring burning (Mohr 1984).

Pronghorn/Antelope (*Antilocapra americana*)—As a primarily forb–eating species with strong requirements for open cover, pronghorn are favorably influenced by the increase in herbaceous species and reduction of shrubs after fire (Higgins, Kruse and Piehl 1989). Nutritional benefits of fire on forage may last up to 4 post–fire years with an increase in primary productivity for a longer period depending upon plant species

Elk (*Cervis elaphus*)—Prescribed fire is used routinely to create or enhance elk habitat in many Western states. Historical evidence shows that early Native Americans used fire to attract ungulates (McCabe 1982). Following fire most preferred elk forage species are enhanced by an increase in nutrients (Asherin 1973). Site preference studies show that elk usually prefer to graze on burned as opposed to unburned sites (Canon 1985).

Black–Tailed Prairie Dog (*Cynomys ludovicianus*)—Fire can be used to stimulate the growth of dogtowns as well as to temporarily halt their rate of growth or to even reduce their size. Prescribed fires immediately adjacent to dogtowns can enhance dogtown expansion by reducing the height and density of bordering ground cover. Fires on areas removed from dogtowns will significantly reduce ungulate use of colony sites. Under such conditions prairie dogs must on their own accomplish the reduction of ground cover required for expansion into uncolonized areas (Klukas 1988).

Appendix D. National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) Compliance

See the Environmental Assessment and Assessment of Affect for the complete appendix D that is being reviewed concurrently with this Fire Management Plan.

Appendix E. Monument Specific Supplemental Information

1. Call- up List

Devils Tower National Monument

Jim Cheatham– Chief of Resource Management	O–307–467–5283 ext 12
Fire Coordinator– Prescribed Fire	H– 307–467–5856
Scot Brown– Chief of Visitor and Resource Protection	O–307–467–5283 ext 21
Fire Coordinator–Suppression	H–307–467–5469
	C–307–290–0009
Lisa Eckert–Superintendent	O–307–467–5283 ext 13
	H–307–283–4233

Northern Great Plains Fire Management

Doug Alexander–FMO	O–605–745–1156
	H–605–890–0783
	C–605–685–5283
Steven Ipswitch–AFMO	O–605–745–1175
	H–605–745–7372
	C–308–862–1061
Karri Fischer–Fire Program Assistant	O–605–745–1155
	H–605–745–3704
	C–308–862–1147

2. Preparedness Inventory

2004 Fire Cache Inventory

ITEM	DESCRIPTION	QUANTITY
INCIDENT ACTION PACKS	EAGLE GEAR, RED CORDURA	5
	TRUE NORTH, BLACK CORDURA	1
	PACK SHACK, BLACK CORDURA	3
	FSS, YELLOW CORDURA	2
	HOTLINE, BLUE CORDURA	2
	TOTAL INCIDENT ACTION PACKS	**13**
GEAR PACKS	FSS, RED CORDURA	11
	PACK SHACK, RED	2
	TOTAL GEAR BAGS	**13**
HARD HATS	YELLOW PARTIAL BRIM, W/ E- Z ADJUST INSERT	13
	YELLOW PARTIAL BRIM, W/ PLASTIC SLIDE ADJUST	6
	BLUE PARTIAL BRIM, "EMT", W/ E- Z ADJUST INSERT	1
	ORANGE, W/ SAWYER PPE, PARTIAL BRIM	3
	TOTAL HARD HATS	**23**
NECK SHROUDS	YELLOW NOMEX W/ VELCRO ATTACHMENTS	19
FIRE SHELTER		24
SHELTER CASE	CORDURA, VARIOUS COLORS	14
HEADLAMPS	PETZL MICRO	4
	CHOUNAIRD "4- D"	13
	CHOUNAIRD "4- AA"	12
	TOTAL HEADLAMPS	**29**
GOGGLES	CLEAR PLASTIC	10
	RUBBER	7
SAFETY GLASSES	CLEAR LENS	22
	DARK LENS	3
	TOTAL EYE PROTECTION	**42 PAIR**
LEATHER GLOVES	FOREST WORKER XS	3
	FOREST WORKER S	7
	FOREST WORKER M	12
	FOREST WORKER L	12
	FOREST WORKER XL	1
	STRUCTURAL FIRE MED- LARGE	4
	TOTAL GLOVES	**39 PAIR**

ITEM	DESCRIPTION	QUANTITY
SLEEPING BAGS	YELLOW FSS	5
	BLUE OR GREEN SYNTHETIC FILL	5
	WHITE "DISPOSABLE"	2
	TOTAL SLEEPING BAGS	**12**
BLANKET	WOOL	2
FOAM PADS	INSULITE	15
TENT	"RANGER"	2
COMPASSES	SILVA	1
	SUNTO	2
	TOTAL COMPASSES	**3**
DUST MASK	3- M PARTICULAR FACE MASK	30
FIRST AID KIT	PERSONAL SIZE IN PLASTIC POCKET CONTAINER	18
EAR PLUGS	FOAM	approx 400
WATER BOTTLES	PLASTIC 1 QUART	approx 135
BOTTLE CARRIERS	CORDURA, VARIOUS COLORS	21
BOTTLE CARRIERS	CANVAS	10
FIRE HANDBOOK	JANUARY 1998 EDITION	4
FIRE HANDBOOK	NOVEMBER 1984 EDITION	2
POCKET GUIDE	INCIDENT RESPONSE POCKET GUIDE JAN. 2002	5
MRE'S	MEALS READY TO EAT, VARIOUS ENTRIES	55

CLOTHING				
ITEM	**DESCRIPTION**			**QUANTITY**
NOMEX SHIRTS	XX LARGE			1
	X LARGE			1
	LARGE			11
	MEDIUM			18
	SMALL			4
			TOTAL SHIRTS	**35**
MEN'S NOMEX PANTS	SIZE	NEW STYLE	OLD STYLE	TOTAL
	28 X 34	2	2	4
	28 X 30	0	3	3
	30 X 30	2	3	5
	30 X 34	1	5	6
	32 X 34	3	12	15
	34 X 34	6	1	7
	36 X 30	0	4	4
	36 X 34	0	4	4
	38 X 30	0	5	5
	38 X 34	2	0	2
	MEN'S PANTS TOTAL	**16**	39	**55**
WOMEN'S NOMEX PANTS	SIZE	NEW STYLE	OLD STYLE	TOTAL
	8	0	2	2
	10	0	3	3
	12	0	1	1
	16	0	2	2
	TOTAL WOMEN'S PANTS	0	8	**8**
BRUSH COATS	SMALL			2
	MEDIUM			6
	LARGE			1
	X LARGE			1
	XX LARGE			1
			TOTAL COATS	**11**
LINERS	SMALL			
	MEDIUM			2
	LARGE			1
	X LARGE			
			TOTAL LINERS	**3**

HAND TOOLS			
ITEM	**DESCRIPTION**		**QUANTITY**
SHOVELS	LONG HANDLED SPADE		35
	SHORT HANDLED SPADE		1
		TOTAL SHOVELS	**36**
AXE	DOUBLE BLADE		8
	SINGLE BLADE		1
	STRUCTURAL FIRE		1
		TOTAL AXES	**10**
FILES	10 inch metal (I w/ handle)	dull	3
	8 inch metal (2 w/ handle)	dull	4
		TOTAL FILES	7
RAKES	TRIANGLE TOOTH		5
	GARDEN		1
		TOTAL RAKES	**6**
PULASKIS			22
McCLOUD			8
FLAP(PER)			4
ENTRECHING TOOL	LONG HANDLE		7
BRUSH BLADE			3
BUCK- SAW	1 PERSON , 51 INCH BLADE		1

3. Draft Delegation of Authority

_____(date)

Memorandum

To: Incident Commander, (_____)

From: Superintendent, Devils Tower National Monument

Subject: Delegation of Authority

The following limited Delegation of Authority is given to you and your Incident Management Team (IMT) to manage the fire suppression, rehabilitation, and related activities for the (INSERT name of fire) Fire. This delegation begins (INSERT date) at (INSERT time) and is valid until rescinded in writing.

Direction and considerations for management of the incident are:

1. Provide for firefighter and public safety. Strive for no lost–time accidents. LCES will be followed.
2. Public information and media relations will be managed by the IMT. All news releases will be approved by the Monument Superintendent or Public Affairs Officer.
3. The IMT will maximize opportunities to training assignments for local NPS employees.
4. The IMT will brief and consult with the Superintendent or his or her designated representative daily.
5. Manage the incident in the most efficient and cost effective manner that is commensurate with resource management standards and guidelines. Final suppression costs should not exceed 120% of the selected WFSA alternative. Documentation and accounting of finance–related issues will be in accordance with procedures of the Accounting Operations Center and the Midwest Region.
6. Identify and protect archeological sites as needed.
7. Provide recycling of all materials used on the incident that can be recycled.
8. Provide initial attack on all new fires in or within 3 miles of the park.
9. Ensure minimum disruption of visitor access to Monument roads and trails consistent with public safety.
10. Ensure that all suppression strategies and tactics are considered which provide for containment with the least possible environmental damage. Key resource considerations are: off–road vehicular traffic, impact to trails, and

fireline scars. Do not use dozers, unless specifically authorized by the Superintendent.

11. A complete incident documentation package, including financial reports, will be completed prior to final demobilization.
12. Copies of all performance ratings will be mailed to the employees' home unit by the IMT.
13. The Agency Administrator's representative will be the Fire Management Officer.

_____ _____

(insert name here) Date

Superintendent, Devils Tower National Monument

Appendix F. Fire Effects Monitoring Plan

Devils Tower National Monument
Fire Effects Monitoring Plan

INTRODUCTION

Prescribed fire will be used to maintain and restore the fire adapted ecosystems at Devils Tower. National Park Service (NPS) Reference Manual 18 states, "Monitoring is a critical component of fire management and the Fire Monitoring Plan is important to identify why monitoring will be done, what will be monitored, how it will be monitored, where it will be done, and how often it will be completed." Monitoring of these fires is mandated in Director's Order #18: Wildland Fire Management issued in 1998. Section 5.2, *Fire Management Plans* (no. 10) states, "Include procedure for short and long term monitoring to document that overall program objectives are being met and undesired effects are not occurring". Section 5.8 directly addresses *Prescribed Fire Monitoring*:

a) Fire effects monitoring must be done to evaluate the degree to which objectives are accomplished.
b) Long- term monitoring is required to document that overall programmatic objectives are being met and undesired effects are not occurring.
c) Evaluation of fire effects data is the joint responsibility of fire management and natural resource management personnel.

MONITORING DESIGN

SAMPLING DESIGN

All plots established at Devils Tower follow standard Fire Monitoring Handbook (FMH) (2003) protocols. The sampling design for the FMH plots are contained in the individual monitoring unit description sheets found in Appendix 1. Long- term photo monitoring points have also been established.

FIELD MEASUREMENT

The individual variables to be measured are defined in the monitoring unit descriptions found in Appendix 1. All plots are marked with steel rebar approximately half a meter in height. Each piece of rebar has a brass tag indicating its location within the plot. The rebar at the zero end of each plot has a tag with complete plot data as specified by the handbook. All locations have been georeferenced with a GPS unit. A hard copy of each plot location is retained in the Northern Great Plains Fire Management Office (NGP) at Wind Cave National Park. A digital text file with UTM coordinates and ArcView

'shape' file are also on file at the NGP. The Northern Great Plains Fire Monitoring Crew will retain copies and backups and will be responsible for providing updated versions to Devils Tower as needed.

MONITORING LOCATION

Currently there are seventeen monitoring plots and four photo points at Devils Tower (Fig. 1).

PRESCRIBED FIRE MONITORING PARAMETERS

Devils Tower has adopted the NPS FMH (2003) as a guide for fire effects monitoring. The handbook identifies four monitoring levels:

Level 1 – Reconnaissance	Fire Cause, location, size, fuel and vegetation types, relative fire activity, potential for spread, current and forecasted weather, resource or safety threats and constraints, and smoke volume and movement
Level 2 – Fire Conditions	Fire monitoring period, ambient conditions – topographic and fire weather, fuel model, fire characteristic, and smoke characteristic
Level 3 – Immediate Post fire Effects	Fuel reduction, vegetative change or other objective dependent variables with in 1 to 5 years after a prescribed fire
Level 4 – Long- term Change	Continued monitoring of Level 3 variables to measure trends and change over time

The FMH plots that have been described in this document thus far are being used to examine levels 3 and 4.

Wildland fires that are suppressed will be monitored at levels 1 and 2 with observations entered into the park's monitoring database. In the event that long- term fire effects plots are burned in a wildland fire, they will be read by the NGP Fire Monitoring Crew, according to the schedule of plot rereads following a prescribed fire treatment. Level 1 and 2 monitoring observations will be filed with the final fire package and a copy placed with the records for the Fire Management Unit that was burned.

Prescribed fires will meet at least the Level 1 and 2 recommended standards. If there are FMH plots in a unit, information on Level 3 and 4 Variables will be collected.

Level 1 variables

Reconnaissance monitoring provides a basic overview of the fire event. The following variables will be collected on all fires.

- Fire cause (origin), location and size

- Fuels and vegetation type
- Relative fire activity
- Potential for further spread
- Current and forecasted weather
- Resource or safety threats and constraints
- Smoke volume and movement

Specific information on the collection of these variables can be found in the NPS Fire Monitoring Handbook (2003) or the RX- 91 – 'Monitoring Prescribed and Wildland Fire' text.

Level 2 variables

Fire conditions monitoring provides information on fire weather, fire behavior and resource values at risk. The following variables will be collected and summarized in a monitoring report on all prescribed fires.

- Fire monitoring period
  - fire number and name
  - observations data and time
  - monitor's name
- Ambient conditions
  - topographic variables
  - slope (%)
  - aspect
- Fire weather variables
  - dry bulb temperature
  - relative humidity
  - wind speed
  - wind direction
  - fuel shading and/or cloud cover
  - time- lag fuel moisture
  - live fuel moisture
- Soil moisture
- Fuel model
- Fire characteristics
  - linear rate of spread
  - perimeter or area growth
  - flame length
  - fire spread directions
- Smoke characteristics (based on state and local requirements)

INTENDED DATA ANALYSIS

Plot installations will be based on prescribed fire priorities and with the intention of achieving a statistically valid sample size within five years for the priority monitoring units. The Northern Great Plains Fire Ecologist will be responsible for checking the minimum plot numbers in all units that have more than five plots installed. Each monitoring unit description delineates the variables that will be analyzed. When minimum plot numbers have been reached, objectives will be evaluated after the data have been checked to meet the assumptions of the statistical test. If the data meet the assumptions, including normality, then confidence intervals will be used for change over time comparisons. If data do not meet the assumptions, a statistician will be consulted. Correlation of Level 2 data with vegetation data can be done with either regression or multivariate analysis.

The Northern Great Plains Fire Ecologist will compare data with fire effects research that has been completed in the park and area. Inconsistencies should lead the ecologist to examine different methodologies, data interpretation, and potential research questions.

MONITORING IMPLEMENTATION SCHEDULE

Timing of monitoring

All plots are currently monitored at peak diversity for the native vegetation approximately halfway between the peak in cool and warm season grasses. This will need to be examined after pilot sampling. All plots are currently being read pre- burn, immediately post- burn, and 1, 2, 5, 10, and 20 years post- burn.

Pre- burn Sampling

Pre- burn sampling will be done during peak phenology. Plots should be installed the growing season before prescribed fires. All plots that have not burned within 2 years of installation will not be reread until that unit is again scheduled to burn. These plots can also be considered for control plots depending on long- term prescribed fire planning.

Post- burn sampling

Post- burn sampling will be done immediately post- burn and 1, 2, 5, 10, and 20 years after the prescribed fire. Plots that burn in the spring will be read at peak phenology that summer, and then at the regular schedule (1, 2, 5, 10, and 20 year). The 1- Year reads for grassland plots burned in the spring are during the growing season the same year as the prescribed fire, and the 2- year read occurs in the following year. The 1- year reads for forest plots burned in the spring are during the growing season one year after the prescribed fire. Fall prescribed fires will be read the following summer as 1 year post-burn reads. If a unit is scheduled to be burned for a second or third time between reads, an additional pre- burn read will be added. For example, a unit burned in the spring of 2000 would be sampled within a week following the fire, 1 year read summer 2000, 2

year read summer 2001, and 5 year read summer 2004. The unit is then scheduled to burn again in 2008. A second pre- burn read should be added summer 2007.

DATA MANAGEMENT

Other monitoring programs have shown that between 25- 40% of the time associated with monitoring should be on data management. The data for Devils Tower is collected and managed by the Northern Great Plains Fire Monitoring Crew located at Wind Cave National Park, Hot Springs, South Dakota. All data collected at Devils Tower will be entered and checked by this crew at their office. Generally the seasonal field staff enters and checks data. This process is supervised the NGP Lead Monitor and Fire Ecologist. Original copies of all data will be kept at the crew's office. Hard copies of the Plot Location Data Sheets will be archived at Devils Tower in the Resource Management files. The Lead Monitor will provide monitoring data to the Devils Tower Resource Management staff annually on CD for archiving. Data are currently entered and analyzed in the FMH software. It is backed up to the server at Wind Cave. It will be sent annually to Devils Tower and the Midwest Regional Ecologist in conjunction with the annual report. Global positioning data of plot locations are stored on CD at the Fire Monitoring Office at Wind Cave.

QUALITY CONTROL

Data quality will be ensured through proper training of the crew in data collection and a system of checks in the data entry process. All data sheets will be checked by the lead crewmember before leaving a plot for data accuracy and completeness. Data will be summarized annually and results reported to the park and regional fire ecologist. A program review should happen every 3- 5 years to maintain consistency of data collection and analysis and re- assessment of program requirements. More frequent review may be necessary if there are significant staffing changes, additional ecological concerns, or by request of the park or monitoring crew.

SOURCES OF DATA ERRORS

Errors in recording can be reduced by checking all data sheets for completeness and accuracy before leaving the plot. Standardized crew training at the beginning of the season will insure all data are being collected in the same manner by all crewmembers. Transcription errors will be corrected by checking all data once entered in the computer. Collecting voucher specimens and using the study collection to verify plant identifications can minimize incorrect identification of plant species. All unknown plant species will be photographed and added to the unknown plant database. These photos can be used as a field reference to insure that all unknowns are consistently observed. Devils Tower Resource Management personnel will be notified of unknowns of particular concern so special attention can be given to identify it. Undersampling of less- frequently occurring species is a large problem in the grass types. An additional sampling technique, nested frequency, will be added after consulting with the regional fire ecologist to better sample the species richness found in these types.

The impacts of monitoring include compacting of fuels and vegetation and the collection of voucher plant specimens. Compaction can be minimized by crew awareness as to where data are collected. Voucher specimens are not collected in the plot – if no other specimen is found, the unknown plant will be photographed and added to the unknown plant photo database. Accurate plot locations including GPS data will aid in plot location and minimize vegetative compaction. Test all directions by having new crewmembers use previously written directions to ensure accuracy. Incomplete or missing data will be corrected as soon as possible. Plot protocols need to be reviewed annually with the seasonal crew prior to beginning work to insure that data are accurately collected. Problems encountered by the field crew must be brought to the attention of the lead monitor and fire ecologist.

RESPONSIBLE PARTIES

Administrative duties will be assigned as follows:

- *Northern Great Plains Fire Ecologist*: Plan revision, crew supervision, data management and data analysis
- *Superintendent, Devils Tower National Monument*: Park liaison
- *Northern Great Plains Lead Monitor*: Data collection, data entry, data management and field crew supervision
- *Midwest Regional Fire Ecologist*: Coordinate program reviews

MANAGEMENT IMPLICATIONS OF MONITORING RESULTS

Monitoring results will be summarized and presented to the park in the fall meeting of the Fire Committee with the NGP Fire management Officer, Prescribed Fire Specialist and Fire Ecologist. This meeting helps coordinate fire activities including prescribed fire for the park in the coming year. The annual report information can be conveyed to Devils Tower Resource Management in an additional meeting as requested.

Review of the data summary and analysis by the NGP Fire Ecologist, Prescribed Fire Specialist, and Devils Tower Resource Management staff should determine if the current program is moving the vegetation towards the desired conditions and/or having unwanted results. Targets should be reviewed and refined, and prescribed fire prescriptions and other vegetation management techniques could be adjusted to compensate. This review could also generate questions that may lead to fire effects research being conducted in the park. Information from the Devils Tower program could be analyzed with other parks from the NGP group as appropriate and should be presented to other parks and at scientific meetings and publications.

CONSULTATION AND COORDINATION

The Northern Great Plains Fire Monitoring Crew is responsible for coordination and consultation with other parks in the group, fire management personnel, and the Midwest Regional Fire Ecologist. Devils Tower Resource Management staff will be responsible for coordination and consultation with the park and all other cooperators.

LITERATURE CITED

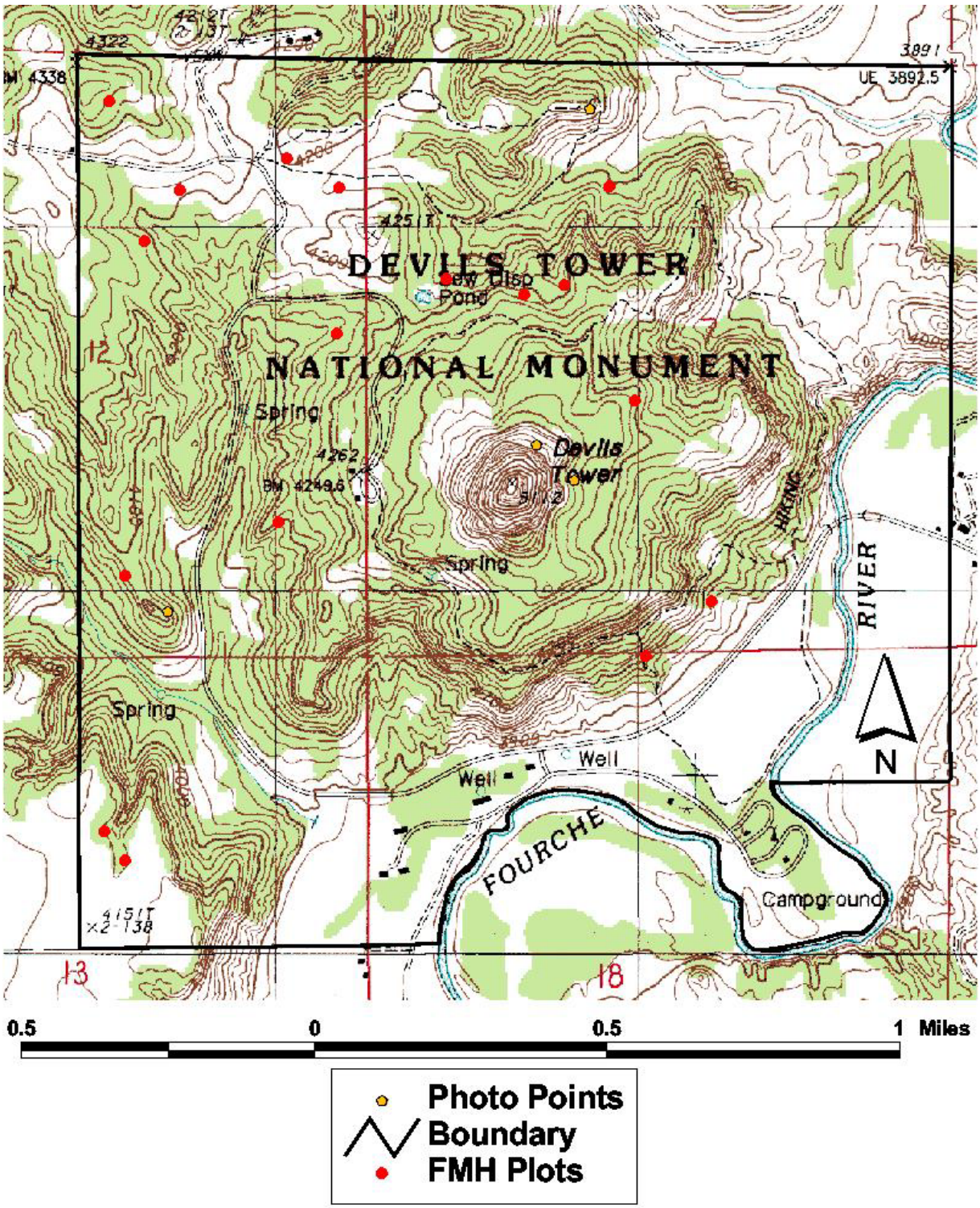
USDI National Park Service. 1998. Directors order #18: wildland fire management.

USDI National Park Service. 1999. Reference manual 18.

USDI National Park Service. 2003. Fire monitoring handbook. National Interagency Fire Center, Boise, ID. 274 pp.

FIGURES

FIGURE 1. LOCATION OF FIRE EFFECTS MONITORING PLOTS.



APPENDICES

APPENDIX 1 – MONITORING UNIT DESCRIPTION SHEETS

FMH- 4 **MONITORING TYPE DESCRIPTION SHEET** Park: **DETO**

Monitoring Type Code: GPOPR1D01 **Date Described**: 6/28/00

Monitoring Type Name: Non- native Grass Prairie – Kentucky bluegrass

Prepared by: A. Thorstenson, K. Paintner

Physical Description
Open meadows within Ponderosa pine forests Soils include: Alice fine sandy loam, Alice Theda Lund complex, Lakoa- Butche complex, Nunn clay loam and Samsil- Gaynor complex. Characteristic soils consist of loamy soils, shallow to deep, well drained, alluvial fans, uplands and terraces, slopes >40%, elevation 3,500 to 5,000 feet, with lower to mid slopes and valleys.

Biological Description
Stands typically have moderate herbaceous cover, ranging from 40- 90% and have dense ground litter. Areas tend to be dominated by non- native cool season grasses, primarily Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*). Native grasses occurring include green needle grass (*Stipa viridula*), side- oats grama (*Bouteloua curtipendula*), western wheatgrass (*Pascopyrum smithii*), needle- and- thread (*Stipa comata*), and sedges (*Carex* spp.). Shrubs include wild rose (*Rosa* spp.), and western snowberry (*Symphoricarpos occidentalis*). Native forbs such as showy milkweed (*Asclepias speciosa*), scurfpea (*Psoralea* spp.), goldenrod (*Solidago* spp.), and common yarrow (*Achillea millefolium*) are common. Non- native forbs found at the monument include yellow sweet clover (*Melilotus officinalis*) and leafy spurge (*Euphorbia esula*).

Selection Criteria
At least 60% grass cover within the plot.

Rejection Criteria
Large outcroppings or barren areas greater than 10% of the plot; slopes >25%; areas with anomalous vegetation; areas dominated by deciduous trees (>30% cover); areas within 30 meters of roads, man- made trails, or human created clearings.

Desired Future Condition
Areas currently dominated by non- native cool season grasses are thought to have been mixed grass prairie, though the exact pre- settlement vegetative composition is not

known. The vision for this community is to reduce the cover of non- native grasses and forbs and increase the relative cover of native grasses and forbs.

Burn Prescription
Units will be burned between April and green- up.

Fire Prescription Elements	
RH: 25- 55%	**Average Rate of Spread: 0- 3 ch/hr**
Temp: 30- 85°F	**Live Fuel Moisture:**
Average Mid- flame Winds: 0- 20 mph	**1- hour TLFM: 6- 14%**
Fuel Loading: 3- 5 tons/acre	**10- hour TLFM: 8- 15%**
Average Flame Length: 0.4- 1.5 ft	**100- hour TLFM:10- 30%**

Monitoring Variables (in order of importance)
- Relative cover of non- native grass
- Relative cover of native grass
- Relative cover of native forbs

Prescribed Fire Goals
- Reduce amount of herbaceous thatch.
- Increase the relative cover of native grasses while reducing relative cover of non-native perennial grasses.
- Decrease the encroachment of ponderosa pine into the open meadow areas.
- Return fire to the grassland ecosystem.

Prescribed Fire Objectives
Immediate Post- burn
- Burn at least 60% of the burnable project area.
- Reduce herbaceous fuel loading by at least 30%.

Two Years Post- burn
- Reduce relative cover of non- native grasses by at least 20%.
- Increase relative cover of native grasses by at least 10%.
- Increase relative cover of native forbs by at least 20%.

Fire Monitoring Objectives
- Install enough plots to be 80% confident that relative cover of native and non- native grasses will be within 25% of the population mean.

Relevant Literature

Fisher, R. F., M. J. Jenkins, and W. F. Fisher. 1987. Fire and the prairie- forest mosaic of Devil's Tower National Monument. American Midland Naturalist 117:250- 257.

Parrish, J. B., D. J. Herman, and D. J. Reyher. 1996. A century of change in Black Hills forest and riparian ecosystems. U.S. Forest Service and South Dakota Agriculture Experiment Station B 722, South Dakota State University, Brookings, SD.

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USDI National Park Service. 2001. Fire monitoring handbook. National Interagency Fire Center, Boise, ID. 288 pp.

Plot Protocols

General Protocols		YES	NO		YES	NO
Preburn	Control Plots/Opt		•	Herb Height/Rec	•	
	Herbaceous Density/Opt		•	Belt Transect Width: 5 meters		
	OP/Origin Buried		•	Abbreviated Tags	•	
	Voucher Specimens/Rec	•		Stakes Installed: All		
	Stereo Photography/Opt		•	Crown Intercept/Opt		•
	Brush Individuals/Rec		•	Herb. Fuel Load/Opt		•
	Herbaceous Data Collected at: 0P- 30P					
Burn	Duff Moisture/Rec		•	Flame Zone Depth/Rec	•	
Postburn	Herbaceous Data/Opt: FMH – 17			Herb. Fuel Load/Opt		•
	100 Pt. Burn Severity/Opt		•			

FMH- 4 MONITORING TYPE DESCRIPTION SHEET Park: **DETO**

Monitoring Type Code: FPIPO1D09 **Date Described:** 6 /20/96

Monitoring Type Name: Ponderosa Pine Forest

Prepared by: G. San Miguel, B. Adams, G. Kemp, P. Reeberg

Updated: A. Thorstenson, K. Rehamn, J. Decoster – April, 2001

Physical Description
Includes upland sites on all aspects and slopes with an elevation from 4,000 to 6,000', which includes upper, mid to lower slopes. Talus slopes and steep slopes (>40% slope) are excluded. Characteristic soils consists of deep, well drained clay or sandy loam of the Larkson- Lakota Series. There are also some areas of exposed sandstone.

Biological Description
Overstory dominated by ponderosa pine (*Pinus ponderosa*). Understory trees include bur oak (*Quercus macrocarpa*), chokecherry (*Prunus virginiana*), and American plum (*Prunus americana*). Shrubs include Oregon grape (*Mahonia repens*), common juniper (*Juniperus communis*), western red current (*Ribes cereum*). Dominant grasses are poverty oat grass (*Danthonia spicata*), needle- and- thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), and non- native Kentucky bluegrass (*Poa pratensis*). Native forbs such as common yarrow (*Achillea millefolium*), milkvetch (*Astragalus* spp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), bedstraw (*Galium* spp.), scurfpea (*Psoralea* spp.), and goldenpea (*Thermopsis rhombifolia*) are common. Non-native forbs found in this monitoring type include yellow sweetclover (*Melilotus officinalis*), Canada thistle (*Cirsium arvense*), hound's tongue (*Cynoglossum officinale*), and leafy spurge (*Euphorbia esula*).

Rejection Criteria
Large outcroppings or barren areas >20% of the plot; areas with anomalous vegetation; monitoring type boundaries; riparian areas or areas dominated by deciduous trees (> 30% cover); areas within 30 meters of roads, man- made trails, or human created clearings; and areas within 20 meters of Woodlands Research exclosures are to be rejected.

Desired Future Conditions
- Decrease non- native species.
- Maintain open- canopy ponderosa pine stands with overstory tree density in a range of 200- 350 stems/ha (80- 140 stems/acre).
- Meadow and forest areas in various diverse stages of development
- Decrease density of pole- sized trees.
- Fuel load levels that are consistent with frequent, low intensity fires

Burn Prescription:
Units will be burned from April to green- up, or Labor Day to the end of November.

Fire Prescription Elements	
RH: 25- 55%	**Average Rate of Spread: 0- 3 ch/hr**
Temp: 30- 85°F	**Live Fuel Moisture:**
Average Mid- flame Winds: 0- 20 mph	**1- hour TLFM: 6- 14%**
Fuel Loading: 3- 5 tons/acre	**10- hour TLFM: 8- 15%**
Average Flame Length: 0.4- 1.5 ft	**100- hour TLFM:10- 30%**

Monitoring Variables (in order of importance)
- Total dead and down fuel load
- Density of overstory ponderosa pine
- Relative cover of herbaceous species
- Density of pole size ponderosa pine

Prescribed Fire Project Objectives
Immediate Post Burn
- Reduce dead and down fuel loading by 30- 70% immediate postburn
- Burn 80- 100% of the project area

One Year Post Burn:
- Reduce density of pole- size ponderosa pine by 30 to70%
- Reduce relative cover of non- native grasses by 30 to 50%
- Increase relative cover of native grasses cover by 10 to 25%
- Increase relative cover of native forb cover by 10 to 25%

Five Year Post Burn
- Maintain 30% reduction of non- native grass relative cover.
- Maintain overstory density of ponderosa pine within 30% of preburn condition.
- Maintain increase of relative cover of native grass and forbs.

Fire Monitoring Objectives:
- Install enough plots to be 80% confident that the relative cover for non- native grasses are within 20% of the true population mean.
- Install enough plots to be 80% confident that the density of pole- size and overstory trees is with 20% of the population mean.
- Install enough plots to be 80 % confident that the fuel load is within 20% of the true population mean.

Data Analysis
- Track relative cover of native and non- native grass in year 1, 2, 5 and 10.
- Track density of pole- size and overstory trees in year 1, 2, 5, and 10.

- Track fuel load in immediate postburn and in year 1, 2, 5, and 10.

Relevant Literature

Arno, S. F. 1988. Fire ecology and its management implications in ponderosa pine forests. Pages 133- 139 *in* D. M. Baumgartner and J. E. Lotan, editors. Ponderosa pine: the species and its management. Symposium Proceedings, Washington State University, Spokane.

Covington, W. W., and M. M. Moore. 1994. Southwestern ponderosa forest structure: changes since Euro- American settlement. Journal of Forestry **92**(1):39- 47.

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Kuchler, A.W. 1964. Potential natural vegetation of the coterminous Untied States. Am. Geogr. Soc. Spec. Publ. 36 (Manual), New York.

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Progulske, D. R. 1974. Yellow ore, yellow hair, yellow pine: a photographic study of a century of forest ecology. Agriculture Experiment Station Bulletin 616, South Dakota State University, Brookings, SD.

USDA, NRCS. 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA.

USDI National Park Service. 2001. Fire monitoring handbook. National Interagency Fire Center, Boise, ID. 288 pp.

Plot Protocols

GENERAL PROTOCOLS		YES	NO		YES	NO
Preburn	Control Plots/Opt		•	Herb Height/Rec	•	
	Herbaceous Density/Opt		•	Belt Transect Width: 5 meters *		
	OP/Origin Buried		•	Abbreviated Tags	•	
	Voucher Specimens/Rec	•		Stakes Installed: All		
	Stereo Photography/Opt		•	Crown Intercept/Opt		•
	Brush Individuals/Rec		•	Herb. Fuel Load/Opt		•
	Herbaceous Data Collected at: **Q4- Q1**					
Burn	Duff Moisture/Rec		•	Flame Zone Depth/Rec	•	
Postburn	Herbaceous Data/Opt: FMH - 17			Herb. Fuel Load/Opt		•
	100 Pt. Burn Severity/Opt		•			

FOREST PLOT PROTOCOLS		YES	NO		YES	NO
Overstory	Area sampled: 50 x 20m			Quarters Sampled: Q1- Q4		
	Tree Damage/Rec	•		Crown Position/Rec	•	
	Dead Tree Damage/Opt		•	Dead Crown Position/Opt		•
Pole- size	Area Sampled: 25 x 10m			Quarters Sampled: Q1		
	Height/Rec	•		Poles Tagged/Rec		•
Seedling	Area Sampled: 5 x 10m			Quarters Sampled: Subset of Q1		
	Height/Rec	•		Seedlings Mapped/Opt		•
Fuel Load	Sampling Plane Length: 6, 6, 12, 50, 50			Fuel Continuity/Opt		•
	Aerial Fuel Load/Opt		•			
Postburn	Char Height/Rec	•		Mortality/Rec	•	

Rec = Recommended Opt = Optional

FMH- 4 **MONITORING TYPE DESCRIPTION SHEET** Park: **DETO**

Monitoring Type Code: FPIPO1D02 **Date Described:** 6 /20/96

Monitoring Type Name: Ponderosa Pine – Mixed- grass Savannah

Preparer: G. San Miguel, B. Adams, G. Kemp, P. Reeberg

Physical Description:
Characteristic soils consist of loamy soils, shallow to deep, well drained, alluvial fans, uplands and terraces, slopes >40%, elevation 3,500 to 5,000 feet, with lower to mid slopes and valleys. Soils include Alice fine sandy loam, Alice Theda Lund complex, Lakoa- Butche complex, Nunn clay loam and Samsil- Gaynor complex.

Biological Description:
Open canopy ponderosa pine (*Pinus ponderosa*) with occasional Rocky Mountain juniper (*Juniperus scopulorum*). Understory trees include bur oak (*Quercus macrocarpa*), chokecherry (*Prunus virginiana*), and American plum (*Prunus americana*). Shrubs include Oregon grape (*Mahonia repens*), common juniper (*Juniperus communis*), western red current (*Ribes cereum*). Dominant grasses are poverty oat grass (*Danthonia spicata*), needle- and- thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), and non- native Kentucky bluegrass (*Poa pratensis*). Native forbs such as common yarrow (*Achillea millefolium*), milkvetch (*Astragalus* spp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), bedstraw (*Galium* spp.), scurfpea (*Psoralea* spp.), and goldenpea (*Thermopsis rhombifolia*) are common. Non- native forbs found in this monitoring type include yellow sweetclover (*Melilotus officinalis*), Canada thistle (*Cirsium arvense*), hound's tongue (*Cynoglossum officinale*), and leafy spurge (*Euphorbia esula*).

Rejection Criteria
Large outcroppings or barren areas >20% of the plot; areas with anomalous vegetation; monitoring type boundaries; riparian areas or areas dominated by deciduous trees (> 30% cover); areas within 30 meters of roads, man- made trails, or human created clearings; and areas within 20 meters of Woodlands Research exclosures are to be rejected.

Desired Future Condition
- Decrease non- native species.
- Maintain open- canopy ponderosa pine stands with overstory tree density in a range of 150- 250 stems/ha (60- 100 stems/acre).
- Meadow and forest areas in various diverse stages of development.
- Decrease density of pole- sized trees.
- Fuel load levels that are consistent with frequent, low intensity fires.

Burn Prescription:
Units will be burned from April to green- up, or Labor Day to the end of November.

Fire Prescription Elements	
RH: **25- 55%**	Average Rate of Spread**: 0- 3 ch/hr**
Temp**: 30- 85°F**	Live Fuel Moisture**:**
Average Mid- flame Winds**: 0- 20 mph**	1- hour TLFM**: 6- 14%**
Fuel Loading**: 3- 5 tons/acre**	10- hour TLFM**: 8- 15%**
Average Flame Length**: 0.4- 1.5 ft**	100- hour TLFM**:10- 30%**

Monitoring Variables (in order of importance)
- Total dead and down fuel load
- Density of pole- size and overstory ponderosa pine
- Relative cover of herbaceous species

Prescribed Fire Project Objectives
Immediate Post Burn
- Reduce dead and down fuel loading by 30- 70% immediate postburn
- Burn 80- 100% of the project area

One Year Post Burn:
- Reduce density of pole- size ponderosa pine by 30 to70%
- Reduce relative cover of non- native grasses by 30 to 50%
- Increase relative cover of native grasses cover by 10 to 25%
- Increase relative cover of native forb cover by 10 to 25%
- Maintain density of juniper, deciduous trees, and shrubs within 15% of preburn density.

Five Year Post Burn
- Maintain 30% reduction of non- native grass relative cover.
- Maintain overstory density of ponderosa pine within 30% of preburn condition.
- Maintain increase of relative cover of native grass and forbs.

Fire Monitoring Objectives:
- Install enough plots to be 80% confident that the relative cover for non- native grasses are within 20% of the true population mean.
- Install enough plots to be 80% confident that the density of pole- size and overstory trees is with 20% of the population mean.
- Install enough plots to be 80 % confident that the fuel load is within 20% of the true population mean.

Data Analysis
- Track relative cover of native and non- native grass in year 1, 2, 5 and 10.

- Track density of pole- size and overstory trees in year 1, 2, 5, and 10.
- Track fuel load in immediate postburn and in year 1, 2, 5, and 10.

Relevant Literature

Arno, S. F. 1988. Fire ecology and its management implications in ponderosa pine forests. Pages 133- 139 *in* D. M. Baumgartner and J. E. Lotan, editors. Ponderosa pine: the species and its management. Symposium Proceedings, Washington State University, Spokane.

Covington, W. W., and M. M. Moore. 1994. Southwestern ponderosa forest structure: changes since Euro- American settlement. Journal of Forestry **92**(1):39- 47.

Fisher, R. F., M. J. Jenkins, and W. F. Fisher. 1987. Fire and the prairie- forest mosaic of Devil's Tower National Monument. American Midland Naturalist **117**:250- 257.

Kuchler, A.W. 1964. Potential natural vegetation of the coterminous Untied States. Am. Geogr. Soc. Spec. Publ. 36 (Manual), New York.

Parrish, J. B., D. J. Herman, and D. J. Reyher. 1996. A century of change in Black Hills forest and riparian ecosystems. U.S. Forest Service and South Dakota Agriculture Experiment Station B 722, South Dakota State University, Brookings, SD.

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USDI National Park Service. 2001. Fire monitoring handbook. National Interagency Fire Center, Boise, ID. 288 pp.

Plot Protocols

GENERAL PROTOCOLS		YES	NO		YES	NO
Preburn	Control Plots/Opt		•	Herb Height/Rec	•	
	Herbaceous Density/Opt		•	Belt Transect Width: 5 meters *		
	OP/Origin Buried		•	Abbreviated Tags	•	
	Voucher Specimens/Rec	•		Stakes Installed: All		
	Stereo Photography/Opt		•	Crown Intercept/Opt		•
	Brush Individuals/Rec		•	Herb. Fuel Load/Opt		•
	Herbaceous Data Collected at: **Q4- Q1**					
Burn	Duff Moisture/Rec		•	Flame Zone Depth/Rec	•	
Postburn	Herbaceous Data/Opt: FMH - 17			Herb. Fuel Load/Opt		•
	100 Pt. Burn Severity/Opt		•			

FOREST PLOT PROTOCOLS		YES	NO		YES	NO
Overstory	Area sampled: 50 x 20m			Quarters Sampled: Q1- Q4		
	Tree Damage/Rec	•		Crown Position/Rec	•	
	Dead Tree Damage/Opt		•	Dead Crown Position/Opt		•
Pole- size	Area Sampled: 25 x 10m			Quarters Sampled: Q1		
	Height/Rec	•		Poles Tagged/Rec		•
Seedling	Area Sampled: 5 x 10m			Quarters Sampled: Subset of Q1		
	Height/Rec	•		Seedlings Mapped/Opt		•
Fuel Load	Sampling Plane Length: 6, 6, 12, 50, 50			Fuel Continuity/Opt		•
	Aerial Fuel Load/Opt		•			
Postburn	Char Height/Rec	•		Mortality/Rec	•	

Rec = Recommended Opt = Optional

* Shrub density will not be collected for Oregon grape

Appendix 2 – Long- term Photo Monitoring

LONG TERM PHOTO MONITORING SHEET

Plot # _____ Park: _____ Date: _____

Burn Unit: _____ Recorders: _____-

_____

UTM Zone:_____	**Camera height: _____ft.**	**Elevation: _____ft**
UTMN:_____	**Lens size: _____mm**	**Slope along transect: _____%**
UTME:_____	**Distance from pole: _____ft.**	**Slope of terrain: _____%**
Datum:_____	**Azimuth from camera to pole: ____**	**No. of Photos Taken: _____**
EPE:_____	**Height on pole used for shot: _____ft**	**Compass Bearing(s):**

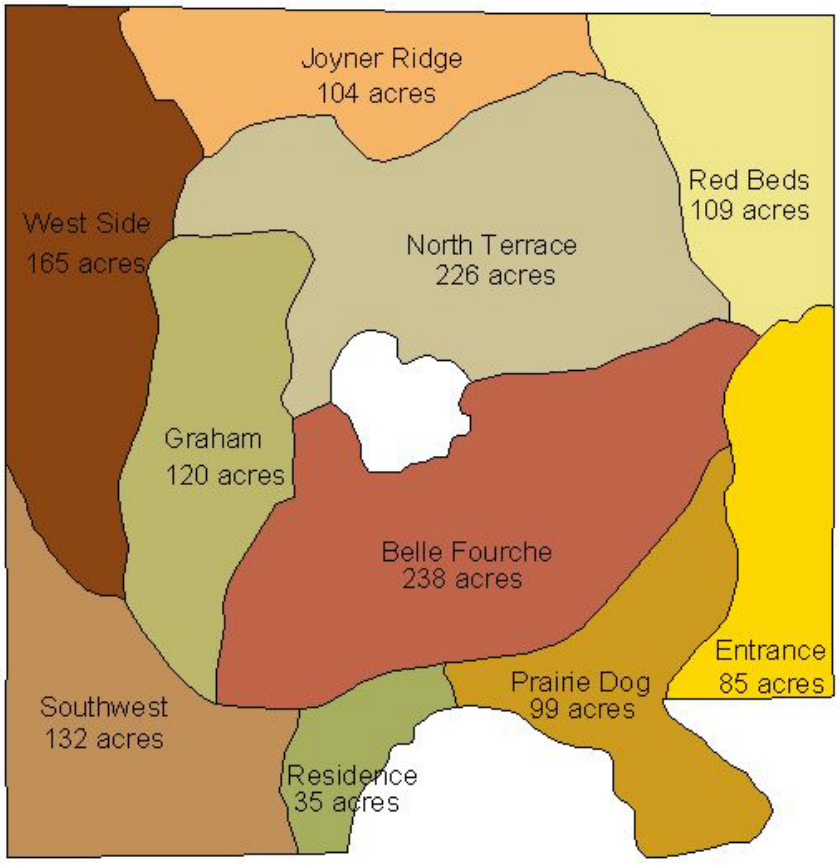
Describe the route to the plot, include or attach a hand drawn map illustrating these directions, including the plot layout, and significant features:

Visit	Initial/ Date	Comments
Install/Pre		
Immediate Post		
1 Year Post		
2 Year Post		
5 Year Post		
10 Year Post		

Appendix G. Pre–Attack Checklist

Function/Item	Available	Needed	Not Needed
Command			
Pre–attack WFSA			
Pre–positioning Needs			
Draft Delegation of Authority	X		
Management Constraints	X		
Interagency Agreements	X		
Evacuation Procedures			
Structural Protection Needs		x	
Closure Procedures			
Operations			
Water Sources	X		
Control Line Locations		x	
Natural Barriers			
Safety Zones			
Flight Routes/Restrictions			
Staging Area Locations			
Helispot/Helibase Locations			
Logistics			
ICP Location			
Roads/Trails with Limitations	X		
Utilities	X		
Medical Facilities	X		
Stores/Restaurants/Services	X		
Rental Equipment Sources			
Construction Contractors			
Sanitary Facilities	X		
Law Enforcement/Fire Departments	X		
Communications (availability)			
Maintenance Facilities	X		
Sanitary Landfills	X		
Planning			
Park Base Map	X		
Area Topographic Maps	X		
Infrared Imagery			
Vegetation/Fuel Maps			
Hazard Maps (ground and aerial)	X		
Special Visitor Use Areas			
Land Ownership Status			X
Archeological/Cultural Resource Maps	X		
Sensitive Plant Area Maps			

Appendix H. Prescribed Fire Unit Map and Schedule



DETO – Prescribed Fires				
FY	**NAME**	**ACRES**	**SEASON**	**OBJECTIVE**
04	North Terrace	226	Fall	Fuel Reduction
05	Southwest	132	Spring	Restoration
08	Joyner Ridge	104	Fall	Fuel Reduction
09	Belle Fourche	238	Fall	Fuel Reduction
DETO – Mechanic Fuel Treatments				
FY	**NAME**	**ACRES**	**SEASON**	**OBJECTIVE**
06	Joyner Ridge	104	Spring	reduce ladder fuels
07	Joyner Ridge	40	Winter	burn piles

Appendix I. Fire Prevention Plan

OBJECTIVES

To reduce the threat of human caused wildland fires through employee and visitor awareness and education.

To reduce the threat of human caused wildland fires arising from improper practices and procedures of residential and outdoor working employees.

GENERAL ACTIONS

All NPS employees, volunteers, and cooperative association employees shall be responsible for becoming familiar with this document and the implementation of its policies.

Interpretive programs will be developed and presented to integrate wildland fire and its prevention as alternative resource management programs.

Fire prevention will become a topic discussed at safety meetings.

There will be a annual inspection of monument for potential risk areas.

HUMAN–CAUSED FIRES 1993–2002

In the ten year study period, there have been no human–caused fires within the boundaries of the monument. This is a remarkable achievement, for which the monument's personnel should be commended

However, monument personnel, usually with the engine, have assisted neighboring agencies on 19 fires near the monument during this 10 year period.

Human–caused fires are not expected to increase in numbers or frequency, although drier weather patterns may facilitate ignition and spread in some years.

NATURALLY–CAUSED FIRES 1993–2002

There was one lightning–caused fire during this period that burned 2–acres—on August 27, 1997.

SPECIFIC FIRE PREVENTION ZONE RATINGS/ACTION ITEMS

FP ZONE #1 – SERVICE AND RESIDENTIAL AREA

RISK

High During fire season, residential occupation is at maximum. All permanent residences and the maintenance shop are equipped with wood burning stoves. The stoves are utilized during the winter, which is the driest season.

HAZARD

Moderate Some Ponderosa pine with flashy grass understory.

VALUE

High Maintenance structures, monument headquarters, and residential housing are located in this area.

SPECIFIC PREVENTION ACTIONS REQUIRED

1. Initiate hazardous fuel reduction program to include inspection and mechanical removal of hazardous materials from around structures and residences.
2. Inspect area annually and monitor throughout fire season for compliance.
3. Education for residents.

Responsible Persons:

Chief Ranger

FP ZONE #2 VISITOR CENTER AND TOWER AREA

RISK

High Significant visitor use in during fire season, in the VC area and the hiking trails near the tower.

HAZARD

Moderate Ground and aerial fuels with paved and unpaved parking lots. Approximately half of this area has been treated with prescribed fire between 1998 and 2002. The area near the visitor center has been thinned specifically to reduce the threat to the visitor center and the other structures, all of the historic with shake shingle roofs.

VALUE

High As stated above, all of the structures in this area are historic.

SPECIFIC PREVENTION ACTIONS REQUIRED

1. Ranger contacts/enforcement.

2. Integrate prevention theme into interpretive talks.

3. Continue to maintain the fuel reduction efforts around the structures. It is especially important to remove the leaves and needles from the roofs and gutters several times a year. During a prescribed fire in 2002 a spot fire occurred in the leaves and needles in the gutters of the visitor center.

Responsible Persons:

Chief Ranger
Seasonal Interpreter Supervisor
Chief of Maintenance

FP ZONE #3 –REMAINDER OF MONUMENT

RISK

Low Low to moderate visitor use.

HAZARD

Moderate Steep to moderate slopes covered with thick to patchy Ponderosa pine overstory with grassy ground cover. Some amount of dead and dying material resulted from prescribed fires.

VALUE

Moderate No structures, however, the monument is surrounded by private land with nearby structures on three of the four sides.

SPECIFIC PREVENTION ACTIONS REQUIRED

1. Covered in the General Actions section.

Responsible Person:

Chief Ranger

structures, however, the monument is surrounded by private land with nearby structures on three of the four sides.

SPECIFIC PREVENTION ACTIONS REQUIRED

1. Covered in the General Actions section.

Responsible Person:

Chief Ranger

National Park Service
U.S. Department of the Interior

Devils Tower National Monument
P.O. Box 154
Devils Tower, WY 82714-0010

www.nps.gov/deto

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